

## INDEX

### A

- abbreviations, 1627
- Abel equation, 443, 525
- active functions, 1628
- adding integration constants, 1665
- additive separable solution, 1374, 1459
- additively separable, 1651, 1710
- adiabatic equation, 1262
- adiabatic exponent, 1262
- adiabatic nonisentropic gas flow, 1204
- adsorption coefficients, 1231
- Airy equation, 861
- Airy functions, 1193
- algebraic equations, 1441
- algebraic equations with even powers, 1441
- algebraic systems of equations, 1441
- alternative definitions of functions, 1628
- analysis of some ordinary differential equations, 1447
- analytical derivation of numerical methods, 1680, 1729
- analytical-numerical solutions, 1680, 1728
- analytical solutions
  - of nonlinear systems, 1659, 1719
  - visualizations, 1629, 1691
- anonymous functions, 1741
- ansatz methods for constructing traveling-wave solutions, 1641, 1700
- antikink, 1636, 1695
- antisoliton, 1636, 1695
- application program interface, 1736
- applied shear stress at boundary, 1252
- arbitrary functions (included in PDEs)
  - dependent on
    - different arguments, 1164
    - linear combination of unknowns, 1133, 1157, 1173, 1178, 1185
    - product of powers of unknowns, 1145, 1162
    - ratio of unknowns, 1137, 1159, 1175, 1181, 1187
    - sum or difference of squares of unknowns, 1146, 1163
    - unknowns in complex way, 1148
- arithmetic operators, 1627, 1738
- array, 1629
- assignment/unassignment operators, 1627
- associativity equations, 972
- auto-Bäcklund transformation, 681, 1413, 1635, 1695
- axial flows, 1303
- axisymmetric fluid flows, 1274
- axisymmetric jet, 910
  - boundary layer approximation, 1335
  - axisymmetric steady laminar hydrodynamic boundary layer equations, 909
  - axisymmetric unsteady laminar boundary layer equations, 929

### B

- Bäcklund transformations, 1413, 1635, 1695
  - auto-Bäcklund transformations, 681, 1413, 1635, 1695
  - canonic for evolution equations, 1420
  - constructed via RF pairs, 1415
  - for second-order equations, 1413
- basic arithmetic operators, 1689
- basic relations used in symmetry analysis of systems of equations, 1527
- basic steps of Painlevé test for nonlinear equations, 1570
- basic transformation rules, 1689
- BBM equation, 958
- Bellman type equations and related equations, 805
- Beltarmi surface, 253
- Benney moment equations, 764
- Bernoulli equation, 394, 421
- Bessel functions, 1160, 1255, 1259
- bilinear functional equations, 1775
- Blasius problem, 904, 1333
- block, 1691
- blow-up regimes, 216
- boolean, 1739
- boolean expression, 1628, 1689
- Born-Infeld equation, 766, 1401
- boundary conditions, 1752
- boundary layer
  - approximation for axisymmetric jet, 1335
  - axisymmetric steady laminar hydrodynamic, 909
  - axisymmetric unsteady laminar, 929
  - equations, 903
  - for non-Newtonian fluid, 915
  - nonlinear diffusion equations, 346, 402
  - nonlinear thermal equations, 346
  - on flat plate, 1333
  - on V-shaped body, 1334
  - steady-state equations, 903
  - steady-state equations for Newtonian fluid, 903
  - steady-state equations for non-Newtonian fluids, 911
  - steady-state laminar, 903
  - symmetries of steady-state equations, 1528
  - unsteady, 917
  - unsteady equations for Newtonian fluid, 917

- boundary layer (*continued*)  
 unsteady equations for non-Newtonian fluids, 930  
 with pressure gradient, 907  
 boundary layer equation for non-Newtonian fluid of general form, 917  
 boundary layer equation for power-law fluid with pressure gradient, 913  
 boundary layer equations (Prandtl equations), 1333  
 boundary value problem, 1679, 1727  
 Boussinesq equation, 368, 1504  
 in canonical form, 987  
 modifications, 987  
 Boussinesq-type equation, 1028  
 Boussinesq transformation, 1289  
 breaking soliton equation, 1030  
 breather, 492  
 brief introduction to Maple, 1625  
 brief introduction to Mathematica, 1687  
 brief introduction to MATLAB, 1735  
 built-in functions, 1740  
 Burgers equation, 186, 1409, 1414, 1572, 1637, 1673, 1677, 1697, 1723, 1725, 1743, 1761  
 Burgers–Huxley equation, 189  
 Burgers–Korteweg–de Vries equation, 884  
 Burgers vortex, 1290
- C**
- Calogero equation, 745, 746  
 Calogero type-equation, 1400  
 Camassa–Holm equation, 968  
 Camassa–Holm multipeakon solutions, 965  
 canonic Bäcklund transformations of evolution equations, 1420  
 canonical form  
 Boussinesq equation, 987  
 for systems of equations, 1611  
 Kadomtsev–Petviashvili equation, 1000  
 Korteweg–de Vries equation, 857  
 modified Korteweg–de Vries equation, 867  
 of elliptic equations, 1392  
 of gas dynamics systems, 1611  
 of hyperbolic equations, 1390–1392  
 of parabolic equations, 1390  
 Cauchy–Lagrange integral, 1201  
 Cauchy problem, 1357, 1379, 1611  
 for Hamilton–Jacobi equation, 1380  
 qualitative features of solutions, 1611  
 centered rarefaction wave, 1359  
 Chaplygin equations, 1202  
 Chaplygin gas equation, 765  
 characteristic, 1393  
 characteristic curves, 1647  
 characteristic equation, 1389, 1393, 1647, 1706  
 characteristic system, 1355  
 characteristic velocity, 1615  
 Charpit equations, 1647, 1706  
 checking whether nonlinear systems of equations of mathematical physics pass Painlevé test, 1576  
 chromatography equations, 1231  
 Clairaut equation, 118, 152, 172  
 in implicit form, 122  
 partial differential, 1375  
 Clarkson–Kruskal direct method, 1503  
 classic worksheet, Maple, 1626  
 classical Cauchy problem, 1647, 1707, 1709, 1756  
 classical Couette–Poiseuille solution, 1263  
 classical hodograph transformation, 1400  
 classical method of separation of variables, 1651, 1711  
 classical method of symmetry reductions, 1513  
 classical self-similar solutions, 1435  
 classical traveling-wave solutions, 1431  
 classification of second-order nonlinear equations, 1389  
 classification results for nonlinear first- and second-order equations, 1565  
 cnoidal waves, 858  
 coefficient of reflection, 1588  
 coefficients of equations contain  
 exponential functions, 11  
 hyperbolic functions, 14  
 logarithmic functions, 16  
 power-law functions, 3  
 trigonometric functions, 17  
 Cole–Hopf transformation, 1573  
 for Burgers equation, 1637, 1696  
 combined KdV–mKdV equation, 871  
 commutator of operators, 1579  
 compacton, 889  
 comparing exact solution generation methods, 1662  
 comparison of asymptotic and numerical solutions, 1684, 1733  
 compatibility condition, 1581  
 complete elliptic integral, 858  
 complete integral, 1373, 1647, 1650, 1706, 1709  
 complete Lin–Reissner–Tsien equation, 757  
 complete solution, 1647, 1706  
 complex separation of variables in nonlinear partial differential equations, 1462  
 composite data types, 1741  
 condition  
 compatibility, 1581  
 condition, for integrability of Pfaffian equation by single relation, 1601  
 Courant–Friedrichs–Levy, 1763  
 invariance, 1516, 1527, 1595  
 invariant, 1527  
 invariant surface, 1533  
 jump, 1362, 1363, 1369  
 Lax, 1616, 1617  
 no-slip, 1253  
 Rankine–Hugoniot, 1126, 1128, 1759  
 Rankine–Hugoniot jump, 1363, 1369, 1615

- condition (*continued*)  
 stability, 1369  
 stability, for generalized solution, 1369  
 strip, 1651, 1710  
 transversality, 1380
- conditions  
 boundary, 1752  
 evolutionary, 1616
- conical vortex flow, 1290
- connection between method of differential constraints and other methods, 1561
- conservation form, 1678, 1725, 1762, 1763
- conservation law at discontinuity, 1363
- conservation laws, 1365, 1593  
 for some nonlinear equations of mathematical physics, 1593
- constructing analytical solutions in terms of predefined functions, 1629
- constructing complete integral using two first integrals, 1377
- constructing exact solutions using symbolic computation, 1662
- constructing finite-difference approximations, 1677, 1725, 1760
- constructing generalized separable solutions, 1661, 1721
- constructing numerical solutions, 1683, 1731  
 in terms of predefined functions, 1672, 1722
- constructing self-similar solutions, 1645, 1705
- constructing separable solutions, 1651, 1710
- constructing solutions along characteristics, 1647, 1706
- constructing solutions of nonlinear equations that fail Painlevé test, using truncated expansions, 1577
- constructing solutions using predefined functions, 1692
- constructing solutions via transformations, 1635, 1694
- constructing traveling-wave solutions, 1637, 1659, 1697, 1719
- constructive solid geometry, 1754
- contact transformations, 1403  
 for ordinary differential equations, 1403
- continuity equation, 1197, 1247, 1610
- continuous point group, 1526
- control structures, 1741
- convective fluid motions, 1329
- coordinates of first and second prolongations, 1515
- Couette–Poiseuille plane flow, 1251
- Couette–Poiseuille type solution, 1283
- Courant–Friedrichs–Levy condition, 1763
- Crocco transformation, 906, 909, 1422
- Crocco variables, 748, 1107
- cylindric Burgers equation, 191
- cylindrical Korteweg–de Vries equation, 866
- cylindrical vortex flow, 1290
- D**
- data structures, 1741
- data types, 1690
- decomposed geometry, 1752
- Degasperis–Procesi equation, 968
- description of simplified scheme for constructing solutions based on presetting one system of coordinate functions, 1465
- desktop, 1737
- determining equation, 1555
- development environment, 1736
- different types of cells, 1688
- differential constraints, 1539, 1545  
 of arbitrary order, 1542
- differential equation  
 adiabatic, 1262  
 Airy, 861  
 BBM, 958  
 Bernoulli, 394, 421  
 Born–Infeld, 766, 1401  
 boundary layer, for non-Newtonian fluid, 917  
 boundary layer, for power-law fluid with pressure gradient, 913  
 Boussinesq, 368, 987, 1504  
 Boussinesq, in canonical form, 987  
 Boussinesq-type, 1028  
 breaking soliton, 1030  
 Burgers, 186, 1409, 1414, 1572, 1637, 1673, 1677, 1697, 1723, 1725, 1743, 1761  
 Burgers–Huxley, 189  
 Burgers–Korteweg–de Vries, 884  
 Calogero, 745, 746  
 Calogero-type, 1400  
 Camassa–Holm, 968  
 Chaplygin, 765  
 characteristic, 1389, 1393, 1647, 1706  
 Clairaut, 118, 152, 172, 1375  
 Clairaut, in implicit form, 122  
 combined KdV–mKdV, 871  
 complete Lin–Reissner–Tsien, 757  
 continuity, 1197, 1247, 1610  
 cylindric Burgers, 191  
 cylindrical Korteweg–de Vries, 866  
 Degasperis–Procesi, 968  
 determining, 1555  
 double sine-Gordon, 492  
 double sinh-Gordon, 485  
 Dym, 878  
 elliptic, 1392  
 Emden–Fowler, 248, 442, 444, 447, 462, 464, 647, 648, 655  
 Enneper, 491  
 Euler–Lagrange, 1595  
 evolution, nonlinear in second derivative, 346  
 fast diffusion, 211  
 first-order quasilinear, 1355  
 first Painlevé, 861, 989

- differential equation (*continued*)  
 Fisher, 176, 1639, 1699, 1744  
 FitzHugh–Nagumo, 179, 1746  
 fKdV, 1034  
 Fokas–Yortsos, 237  
 fourth-order, Liouville type, 1030  
 fourth Painlevé, 988  
 Fujita–Storm, 212  
 Gardner, 871  
 Gauss, 1772  
 general fifth-order KdV, 1034  
 generalized Burgers, 288  
 generalized Burgers–Korteweg–de Vries, 1045, 1503  
 generalized Calogero, 748  
 generalized Emden–Fowler, 327, 477, 511, 512, 513, 516, 527, 528, 697, 698  
 generalized Kadomtsev–Petviashvili, 1029  
 generalized Khokhlov–Zabolotskaya, 751  
 generalized Korteweg–de Vries, 871  
 generalized Kuramoto–Sivashinsky, 983  
 generalized Landau–Ginzburg, 360  
 generalized Liouville, 1108  
 Gibbons–Tsarev, 764  
 Goursat, 549  
 Grad–Shafranov, 678, 691  
 Hamilton–Jacobi, 1379  
 Hamilton–Jacobi, Cauchy problem, 1380  
 Harry Dym, 878  
 Helmholtz, 380, 397, 399, 420, 423, 558, 570, 601, 938, 1289  
 homogeneous Monge–Ampère, 775, 1430  
 Hopf, 5  
 Hunter–Saxton, 745  
 hydrodynamic boundary layer, with pressure gradient, 907  
 hyperbolic, first canonical form, 1391  
 hyperbolic, second canonical form, 1392  
 hypergeometric, 1012  
 integrating factor of Pfaffian, 1601  
 inviscid Burgers, 1674, 1763  
 inviscid Burgers (explicit method), 1678, 1725  
 inviscid Burgers (initial value problem), 1762  
 inviscid Burgers (shock waves and rarefaction waves), 1757  
 inviscid Burgers (shock waves and weak solutions), 1759  
 Ito, 1037  
 Kadomtsev–Petviashvili, 1000, 1587  
 Kadomtsev–Petviashvili, in canonical form, 1000  
 Kadomtsev–Petviashvili type, 1002  
 Kármán–Howarth, 253  
 Kaup–Kupershmidt, 1036  
 Kawahara, 1032  
 KdV, 857  
 Khokhlov–Zabolotskaya, 749  
 KK, 1036  
 Klein–Gordon, 1641, 1656, 1701, 1716  
 $k(n, n)$ , 891  
 Kolmogorov–Petrovskii–Piskunov (KPP), 279, 1633, 1694  
 Korteweg–de Vries, 857, 1574, 1580, 1583, 1638, 1698  
 Korteweg–de Vries–Burgers, 884  
 Korteweg–de Vries, in canonical form, 857  
 Korteweg–de Vries type, with exponential nonlinearity, 874  
 Korteweg–de Vries type, with logarithmic nonlinearity, 874  
 Korteweg–de Vries type, with power-law nonlinearity, 872  
 KPP-type, 1633, 1694  
 Kuramoto–Sivashinsky, 982  
 Laplace, 394, 409, 421, 556, 558, 579, 646, 938, 1392  
 Lax, 1035, 1068  
 Lax, with forcing term, 1037  
 Lin–Reissner–Tsien, 756, 759  
 linear determining, 1556, 1557  
 linear heat, 807, 1252  
 linear Schrödinger, 865, 1186  
 linear wave, 1392  
 Liouville, 144, 165, 470, 540, 1117, 1414  
 Liouville type,  $n$ th-order, 1109  
 mKdV, 867  
 model, for dynamics of nonlinear strings, 534  
 model, of gas dynamics, 5, 25, 1360  
 model, of nonlinear waves with damping, 6  
 modification of coupled KdV, 1172  
 modified Burgers, 191  
 modified Burgers–Korteweg–de Vries, 886  
 modified Harry Dym, 891  
 modified  $k(n, n)$ , 892  
 modified Korteweg–de Vries, 862, 866, 869, 1583  
 modified Korteweg–de Vries–Burgers, 886  
 modified Korteweg–de Vries, in canonical form, 867  
 Monge–Ampère, 774, 1393  
 $n$ -dimensional modified Schrödinger, with cubic nonlinearity, 431  
 $n$ -dimensional Schrödinger, with cubic nonlinearity, 430  
 Newell–Whitehead, 1534  
 ninth-order KdV-type, 1041  
 nonlinear diffusion, 1645, 1705  
 nonlinear diffusion, with cubic source, 1577  
 nonlinear first-order partial differential, 1373  
 nonlinear Klein–Gordon, 499, 1494  
 nonlinear Kolmogorov type, 377, 398  
 nonlinear Poisson, 1679, 1727, 1750  
 nonlinear Poisson–Boltzmann, 1755  
 nonlinear Schrödinger, 348, 425, 1582  
 nonlinear wave, 1400, 1519, 1536, 1673, 1678, 1723, 1727, 1764

- differential equation (*continued*)  
 $n$ th-order Liouville type, 1109  
of axisymmetric steady hydrodynamic boundary layer, 1508  
of Burgers hierarchy, 1067  
of complete Korteweg–de Vries hierarchy, 1069  
of helical surface, 8  
of Korteweg–de Vries hierarchy, 1068  
of light rays, 63  
of minimal surfaces, 768, 1597  
of modified Korteweg–de Vries hierarchy, 1069  
of steady transonic gas flow, 657  
of surface of bodies of revolution, 8  
of unsteady transonic gas flows, 756  
one-soliton solution, mKdV, 867  
one-soliton solution, potential KdV, 876  
Ostrovsky, 968  
palindromic, 1442  
Pfaffian, 1600  
Pfaffian, condition for integrability by single relation, 1601  
Plebański, first heavenly, 802  
Plebański, second heavenly, 803  
Poisson, 379, 397, 423, 580, 588, 938, 1008  
porous medium, 210  
potential, of one-dimensional flow of compressible gas, 768  
potential Korteweg–de Vries (KdV), 876  
potential modified Korteweg–de Vries (mKdV), 877  
Rayleigh–Zababakhin–Plesset, 1262  
Riccati, 140, 142, 162, 164, 423, 425, 453, 482, 520, 1012, 1277  
Sawada–Kotera, 1035  
Sawada–Kotera, with forcing term, 1038  
Schrödinger, of general form, 358, 360, 363, 364  
Schrödinger, with cubic nonlinearity, 348, 350, 351, 352, 355  
Schrödinger, with power-law nonlinearity, 351, 353  
Schwarzian Korteweg–de Vries, 870  
second-order nonlinear partial differential, 1392  
second-order quasilinear partial differential, 1393  
second Painlevé, 861, 867, 988, 989  
seventh-order KdV-type, 1040  
Sharm–Tasso–Olver, 887, 1067  
sine-Gordon, 485, 490, 543, 1117, 1635, 1639, 1646, 1695, 1698, 1706  
sinh-Gordon, 485, 542, 1580  
SK, 1035  
spherical Korteweg–de Vries, 866  
stationary heat, with nonlinear source, 682  
stationary Khokhlov–Zabolotskaya, 649  
telegraph, 494, 538, 583, 585  
thin film, 985  
third-order Liouville type, 972  
Thomas, 544  
three-dimensional Khokhlov–Zabolotskaya, 752  
three-dimensional nonlinear Schrödinger, of general form, 429  
three-dimensional Schrödinger, with cubic nonlinearity, 428  
tractrix, 253  
Tricomi, 659  
two-dimensional Khokhlov–Zabolotskaya, 749  
two-dimensional linear heat, 1256  
two-dimensional nonlinear Schrödinger, of general form, 427  
two-dimensional Schrödinger, with cubic nonlinearity, 425  
two-dimensional Schrödinger, with power-law nonlinearity, 427  
Tzitzéica, 541  
unnormalized Boussinesq, 990  
unnormalized Burgers, 187  
unnormalized Kadomtsev–Petviashvili, 1002  
unnormalized Korteweg–de Vries, 865  
unnormalized modified Korteweg–de Vries, 870  
variant of modified Burgers–Korteweg–de Vries, 886  
vector Burgers, 417  
Weber, 1193  
Yermakov, 309, 518  
differential equations  
admitting variational form, 1595  
associativity, 972  
axisymmetric steady laminar hydrodynamic boundary layer, 909  
axisymmetric unsteady laminar boundary layer, 929  
basic steps of Painlevé test, 1570  
Bellman type, 805  
Benney moment, 764  
boundary layer (Prandtl equations), 1333  
elliptic, canonical form, 1392  
evolution, canonic Bäcklund transformations, 1420  
Chaplygin, 1202  
Charpit, 1647, 1706  
chromatography, 1231  
coefficients contain exponential functions, 11  
coefficients contain hyperbolic functions, 14  
coefficients contain logarithmic functions, 16  
coefficients contain power-law functions, 3  
coefficients contain trigonometric functions, 17  
cubic in derivatives, 134  
Euler, 938, 1197, 1681, 1729  
Euler, for barotropic gas flow, 1201

- differential equations (*continued*)
- Euler, in Gromeka–Lamb form, 1201
  - Euler, in various coordinate systems, 1197
  - evolution, nonlinear in second derivative, 346
  - exact methods, 1353
  - explicitly dependent on  $x$  and/or  $t$ , 266
  - fifth-order, 1031
  - first-order with two independent variables
    - quadratic in derivatives, 43
  - first-order with three or more independent variables, 125
  - first-order with two independent variables of general form, 99
  - first-order quasilinear, 3
  - for convective fluid motions, 1329
  - fourth-order, 977
  - heat and mass transfer, 697
  - heat and mass transfer, in quiescent or moving media with chemical reactions, 390
  - heat and mass transfer, with complicating factors, 734
  - heat, with power-law or exponential temperature-dependent thermal diffusivity, 409
  - hydrodynamic boundary layer, 903
  - hydrodynamic type, order reduction, 1422
  - hyperbolic, canonical form, 1390
  - invariance under scaling transformations, 1431
  - invariance under translations, 1429
  - involving arbitrary differential operators, 1101
  - involving arbitrary functions, 77, 279, 390, 499, 546, 682
  - involving arbitrary functions of derivatives, 113
  - involving arbitrary functions of four variables, 123
  - involving arbitrary functions of independent variables, 107
  - involving arbitrary functions of one variable, 19, 113
  - involving arbitrary functions of three variables, 120
  - involving arbitrary functions of two variables, 30, 116, 168
  - involving arbitrary parameters, 43, 540
  - involving arbitrary powers of derivatives, 102, 136
  - involving cosine, 276
  - involving cotangent, 278
  - involving derivatives in radicands, 101
  - involving exponential nonlinearities, 587
  - involving first derivative in  $t$ , 811, 857, 977
  - involving first derivative in  $t$  and linear in highest derivative, 1031
  - involving fourth powers of derivatives, 99
  - involving hyperbolic cosine, 268
  - involving hyperbolic cotangent, 270
  - involving hyperbolic sine, 269
  - involving hyperbolic tangent, 270
  - involving inverse trigonometric functions, 279
  - involving mixed derivatives, 1000, 1103
  - involving one arbitrary power of derivative, 107
  - involving power-law functions of derivatives, 156
  - involving power-law nonlinearities, 583
  - involving products of derivatives, 133
  - involving products of derivatives with respect to different variables, 131
  - involving roots and moduli of derivatives, 136
  - involving second derivative in  $t$ , 896, 987, 1088
  - involving second-order mixed derivatives, 949
  - involving sine, 277
  - involving squares of derivatives, 133
  - involving squares of one or two derivatives, 125
  - involving squares of three derivatives, 130
  - involving tangent, 278
  - involving third-order mixed derivatives, 958
  - involving two or more second derivatives, 839
  - involving two or three arbitrary powers of derivatives, 111
  - linear in mixed derivative, 745, 847
  - mathematical physics, Painlevé test, 1565
  - mathematical physics, transformations, 1395
  - Navier–Stokes, 1247
  - Navier–Stokes, general properties, 1249
  - Navier–Stokes, in Boussinesq approximation, 1329
  - Navier–Stokes, in various coordinate systems, 1247
  - nonlinear, involving arbitrary parameters, 99
  - nonlinear diffusion boundary layer, 402
  - nonlinear elliptic, geometrical models, 1754
  - nonlinear elliptic, in two space dimensions, 1748
  - nonlinear, in highest derivatives, 404
  - nonlinear, in two independent variables, 1392
  - nonlinear, involving arbitrary linear differential operators, 1065
  - nonlinear, of general form, 150, 169, 1392
  - nonlinear, of thermal (diffusion) boundary layer, 346
  - nonlinear, parabolic, 1677, 1725
  - nonlinear, second-order, 1516
  - nonlinear, simple separation of variables, 1459

- differential equations (*continued*)
- nonlinear telegraph, with two space variables, 583
  - nonlinear, with arbitrary number of variables involving arbitrary functions, 162
  - nonlinear, with arbitrary number of variables involving arbitrary parameters, 158
  - nonlinear, with four independent variables, 154
  - nonlinear, with three variables involving arbitrary functions, 139
  - nonlinear, with three variables quadratic in derivatives, 125
  - nonstationary, 942
  - nonstationary hydrodynamic (Navier–Stokes equations), 1013
  - nonstationary, of motion of viscous incompressible fluid, 1013
  - of atmospheric circulation in equatorial region, 1225
  - of breeze and monsoons, 1223
  - of Burgers and Korteweg–de Vries hierarchies, 1067
  - of dynamic convection in the sea, 1227
  - of flows in the baroclinic layer of the ocean, 1229
  - of general form, involving arbitrary functions of single argument, 358
  - of general form, involving arbitrary functions of two arguments, 362
  - of general form, involving first derivative in  $t$ , 1070
  - of heat and mass transfer in anisotropic media, 412
  - of higher orders, 1031
  - of ideal incompressible fluid, 942
  - of ideal plasticity, 1238
  - of mass transfer in quiescent or moving media with chemical reactions, 406
  - of motion of ideal fluid (Euler equations), 938, 1197
  - of nonlinear vibrations stratified medium, 1131
  - of sixth- to ninth-order, 1039
  - of stationary transonic plane-parallel gas flow, 1122
  - of viscous incompressible fluid, 1003
  - ordinary differential, 1445
  - ordinary differential, Painlevé test, 1566
  - Painlevé, 1566
  - parabolic, canonical form, 1390
  - passing Painlevé test, 1572
  - Pfaffian, 1600
  - Pfaffian, not satisfying integrability condition, 1602
  - Plebański heavenly, 802
  - quadratic in derivatives, 139, 154, 158, 162
  - quadratic in highest derivatives, 772
  - quasilinear, 1393, 1647, 1649, 1707, 1708
  - quasilinear, discontinuous solutions, 1360
  - quasilinear, in conservative form, 1368
  - quasilinear, of general form, 1368
  - quasilinear, qualitative features, 1360
  - quasilinear, with  $n$  independent variables, 1356
  - reducible to Korteweg–de Vries equation, 875
  - second-order, classification, 1389
  - second-order, elliptic, with three or more space variables, 713
  - second-order, elliptic, with two space variables, 641
  - second-order, evolution, 1547
  - second-order, hyperbolic, 1551
  - second-order, hyperbolic, with one space variable, 433
  - second-order, hyperbolic, with two or more space variables, 553
  - second-order, involving mixed derivatives and some other, 745
  - second-order, involving real functions of real variables, 1165
  - second-order, nonlinear, for laser systems, 1170
  - second-order, of general form, 811, 1553
  - second-order, parabolic, with one space variable, 175
  - second-order, parabolic, with two or more space variables, 367
  - semilinear, in two independent variables, 1389
  - shallow water, 1124
  - stationary, 938
  - stationary hydrodynamic, (Navier–Stokes equations), 1003
  - steady boundary layer, for non-Newtonian fluids, 911
  - steady hydrodynamic boundary layer, for Newtonian fluid, 903
  - steady hydrodynamic boundary layer, symmetries, 1528
  - steady-state hydrodynamic boundary layer, 903
  - third-order, 857
  - three-argument functional, 1497
  - three-dimensional, 1240
  - three-dimensional, involving arbitrary functions, 730
  - three-dimensional, of ideal plasticity, 1240
  - three and  $n$ -dimensional, 428
  - with arbitrary dependence on derivatives, 148
  - with arbitrary number of independent variables, 39
  - with cubic nonlinearities involving arbitrary functions, 355
  - with exponential nonlinearities, 254, 469, 662
  - with hyperbolic nonlinearities, 268, 485, 675

- differential equations (*continued*)  
 with logarithmic nonlinearities, 271, 388, 486, 677  
 with  $n$  independent variables, 739, 853  
 with  $n$  space variables, 417  
 with power-law nonlinearities, 175, 433, 641, 808  
 with power-law nonlinearity in derivatives, 161, 167  
 with power nonlinearity in derivatives, 146  
 with quadratic nonlinearities, 805, 896  
 with three independent variables, 35, 838  
 with three or more space variables, 406  
 with three or more space variables involving arbitrary functions, 624  
 with three space variables involving arbitrary parameters, 604  
 with three space variables involving exponential nonlinearities, 722  
 with three space variables involving power-law nonlinearities, 713  
 with trigonometric nonlinearities, 276, 389, 680  
 with two independent variables, 1355  
 with two independent variables involving arbitrary functions, 19  
 with two independent variables involving arbitrary parameters, 3  
 with two independent variables, nonlinear in two or more highest derivatives, 849  
 with two space variables involving arbitrary functions, 589  
 with two space variables involving exponential nonlinearities, 384, 574  
 with two space variables involving power-law nonlinearities, 367, 553  
 two-dimensional, 425, 1238  
 two-dimensional Euler, for incompressible ideal fluid (plane flows), 1198  
 unsteady boundary layer, for Newtonian fluid, 917  
 unsteady boundary layer, for non-Newtonian fluids, 930  
 von Kármán (fourth-order elliptic equations), 1192  
 differential substitutions, 1409  
 differentiation method, 1492  
 direct and inverse scattering problems, 1587  
 direct method of symmetry reductions and differential constraints, 1562  
 direct method of symmetry reductions of nonlinear equations, 1503  
 double-precision floating point, 1740  
 double sine-Gordon equation, 492  
 double sinh-Gordon equation, 485  
 Dym equation, 878  
 dynamic output, 1691  
 dynamics of shallow water, 1610
- E**
- editor, MATLAB, 1737
- Eigen–Schuster model, 1137  
 Ekman flow, 1282  
 elementary symmetric polynomial, 1444  
 elementary theory of using invariants for solving equations, 1439  
 ellipsoidal vortex, 1278  
 elliptic equation, 1392  
 Emden–Fowler equation, 248, 442, 444, 447, 462, 464, 647, 648, 655  
 Enneper equation, 491  
 equation  
 adiabatic, 1262  
 Airy, 861  
 BBM, 958  
 Bernoulli, 394, 421  
 Born–Infeld, 766, 1401  
 boundary layer, for non-Newtonian fluid, 917  
 boundary layer, for power-law fluid with pressure gradient, 913  
 Boussinesq, 368, 987, 1504  
 Boussinesq, in canonical form, 987  
 Boussinesq-type, 1028  
 breaking soliton, 1030  
 Burgers, 186, 1409, 1414, 1572, 1637, 1673, 1677, 1697, 1723, 1725, 1743, 1761  
 Burgers–Huxley, 189  
 Burgers–Korteweg–de Vries, 884  
 Calogero, 745, 746  
 Calogero-type, 1400  
 Camassa–Holm, 968  
 Chaplygin, 765  
 characteristic, 1389, 1393, 1647, 1706  
 Clairaut, 118, 152, 172, 1375  
 Clairaut, in implicit form, 122  
 combined KdV–mKdV, 871  
 complete Lin–Reissner–Tsien, 757  
 continuity, 1197, 1247, 1610  
 cylindrical Burgers, 191  
 cylindrical Korteweg–de Vries, 866  
 Degasperis–Procesi, 968  
 determining, 1555  
 double sine-Gordon, 492  
 double sinh-Gordon, 485  
 Dym, 878  
 elliptic, 1392  
 Emden–Fowler, 248, 442, 444, 447, 462, 464, 647, 648, 655  
 Enneper, 491  
 Euler–Lagrange, 1595  
 evolution, nonlinear in second derivative, 346  
 fast diffusion, 211  
 first-order quasilinear, 1355  
 first Painlevé, 861, 989  
 Fisher, 176, 1639, 1699, 1744  
 FitzHugh–Nagumo, 179, 1746  
 fKdV, 1034  
 Fokas–Yortsos, 237  
 fourth-order, Liouville-type, 1030



- equation (*continued*)  
 fourth Painlevé, 988  
 Fujita–Storm, 212  
 functional, 1498, 1500, 1767, 1769  
 functional, describing traveling-wave solutions, 1431  
 Gardner, 871  
 Gauss, 1772  
 Gelfand–Levitan–Marchenko, integral, 863, 868, 990, 1002  
 Gelfand–Levitan–Marchenko type, integral, 1584  
 general fifth-order KdV, 1034  
 generalized Burgers, 288  
 generalized Burgers–Korteweg–de Vries, 1045, 1503  
 generalized Calogero, 748  
 generalized Emden–Fowler, 327, 477, 511, 512, 513, 516, 527, 528, 697, 698  
 generalized Kadomtsev–Petviashvili, 1029  
 generalized Khokhlov–Zabolotskaya, 751  
 generalized Korteweg–de Vries, 871  
 generalized Kuramoto–Sivashinsky, 983  
 generalized Landau–Ginzburg, 360  
 generalized Liouville, 1108  
 generalized reciprocal polynomial, 1443  
 Gibbons–Tsarev, 764  
 Goursat, 549  
 Grad–Shafranov, 678, 691  
 Hamilton–Jacobi, 1379  
 Hamilton–Jacobi, Cauchy problem, 1380  
 Harry Dym, 878  
 Helmholtz, 380, 397, 399, 420, 423, 558, 570, 601, 938, 1289  
 homogeneous Monge–Ampère, 775, 1430  
 Hopf, 5  
 Hunter–Saxton, 745  
 hydrodynamic boundary layer, with pressure gradient, 907  
 hyperbolic, first canonical form, 1391  
 hyperbolic, second canonical form, 1392  
 hypergeometric, 1012  
 inviscid Burgers, 1674, 1763  
 inviscid Burgers, explicit method, 1678, 1725  
 inviscid Burgers, initial value problem, 1762  
 inviscid Burgers, shock waves and rarefaction waves, 1757  
 inviscid Burgers, shock waves and weak solutions, 1759  
 Ito, 1037  
 Kadomtsev–Petviashvili, 1000, 1587  
 Kadomtsev–Petviashvili, in canonical form, 1000  
 Kadomtsev–Petviashvili type, 1002  
 Kármán–Howarth, 253  
 Kaup–Kupershmidt, 1036  
 Kawahara, 1032  
 KdV, 857  
 Khokhlov–Zabolotskaya, 749  
 KK, 1036  
 Klein–Gordon, 1641, 1656, 1701, 1716  
 $k(n, n)$ , 891  
 Kolmogorov–Petrovskii–Piskunov (KPP), 279, 1633, 1694  
 Korteweg–de Vries, 857, 1574, 1580, 1583, 1638, 1698  
 Korteweg–de Vries, in canonical form, 857  
 Korteweg–de Vries–Burgers, 884  
 Korteweg–de Vries type, with exponential nonlinearity, 874  
 Korteweg–de Vries type, with logarithmic nonlinearity, 874  
 Korteweg–de Vries type, with power-law nonlinearity, 872  
 KPP-type, 1633, 1694  
 Kuramoto–Sivashinsky, 982  
 Laplace, 394, 409, 421, 556, 558, 579, 646, 938, 1392  
 Lax, 1035, 1068  
 Lax, with forcing term, 1037  
 Lin–Reissner–Tsien, 756, 759  
 linear determining, 1556, 1557  
 linear heat, 807, 1252  
 linear Schrödinger, 865, 1186  
 linear wave, 1392  
 Liouville, 144, 165, 470, 540, 1117, 1414  
 mKdV, 867  
 model, for dynamics of nonlinear strings, 534  
 model, of gas dynamics, 5, 25, 1360  
 model, of nonlinear waves with damping, 6  
 modification of coupled KdV, 1172  
 modified  $k(n, n)$ , 892  
 modified Burgers, 191  
 modified Burgers–Korteweg–de Vries, 886  
 modified Harry Dym, 891  
 modified Korteweg–de Vries, 862, 866, 869, 1583  
 modified Korteweg–de Vries, in canonical form, 867  
 modified Korteweg–de Vries–Burgers, 886  
 Monge–Ampère, 774, 1393  
 $n$ -dimensional modified Schrödinger, with cubic nonlinearity, 431  
 $n$ -dimensional Schrödinger, with cubic nonlinearity, 430  
 Newell–Whitehead, 1534  
 ninth-order KdV-type, 1041  
 nonlinear diffusion, 1645, 1705  
 nonlinear diffusion, with cubic source, 1577  
 nonlinear first-order partial differential, 1373  
 nonlinear Klein–Gordon, 499, 1494  
 nonlinear Kolmogorov type, 377, 398  
 nonlinear Poisson, 1679, 1727, 1750  
 nonlinear Poisson–Boltzmann, 1755  
 nonlinear Schrödinger, 348, 425, 1582

- equation (*continued*)
- nonlinear wave, 1400, 1519, 1536, 1673, 1678, 1723, 1727, 1764
  - $n$ th-order Liouville type, 1109
  - of axisymmetric steady hydrodynamic boundary layer, 1508
  - of Burgers hierarchy, 1067
  - of complete Korteweg–de Vries hierarchy, 1069
  - of helical surface, 8
  - of Korteweg–de Vries hierarchy, 1068
  - of light rays, 63
  - of minimal surfaces, 768, 1597
  - of modified Korteweg–de Vries hierarchy, 1069
  - of steady transonic gas flow, 657
  - of surface of bodies of revolution, 8
  - of unsteady transonic gas flows, 756
  - one-soliton solution, mKdV, 867
  - one-soliton solution, potential KdV, 876
  - Ostrovsky, 968
  - palindromic, 1442
  - Pexider, 1771
  - Pfaffian, 1600
  - Pfaffian, condition for integrability by single relation, 1601
  - Pfaffian, integrating factor, 1601
  - Plebański first heavenly, 802
  - Plebański second heavenly, 803
  - Poisson, 379, 397, 423, 580, 588, 938, 1008
  - porous medium, 210
  - potential, of one-dimensional flow of compressible gas, 768
  - potential Korteweg–de Vries (KdV), 876
  - potential modified Korteweg–de Vries (mKdV), 877
  - Rayleigh–Zababakhin–Plesset, 1262
  - reciprocal, 1442
  - Riccati, 140, 142, 162, 164, 423, 425, 453, 482, 520, 1012, 1277
  - Sawada–Kotera, 1035
  - Sawada–Kotera, with forcing term, 1038
  - Schrödinger, of general form, 358, 360, 363, 364
  - Schrödinger, with cubic nonlinearity, 348, 350, 351, 352, 355
  - Schrödinger, with power-law nonlinearity, 351, 353
  - Schwarzian Korteweg–de Vries, 870
  - second-order nonlinear partial differential, 1392
  - second-order quasilinear partial differential, 1393
  - second Painlevé, 861, 867, 988, 989
  - seventh-order KdV-type, 1040
  - Sharm–Tasso–Olver, 887, 1067
  - sine-Gordon, 485, 490, 543, 1117, 1635, 1639, 1646, 1695, 1698, 1706
  - sinh-Gordon, 485, 542, 1580
  - SK, 1035
  - spherical Korteweg–de Vries, 866
  - stationary heat, with nonlinear source, 682
  - stationary Khokhlov–Zabolotskaya, 649
  - telegraph, 494, 538, 583, 585
  - thin film, 985
  - third-order Liouville type, 972
  - Thomas, 544
  - three-dimensional, Khokhlov–Zabolotskaya, 752
  - three-dimensional, Schrödinger, nonlinear, of general form, 429
  - three-dimensional, Schrödinger, with cubic nonlinearity, 428
  - tractrix, 253
  - Tricomi, 659
  - two-dimensional, heat, linear, 1256
  - two-dimensional, Khokhlov–Zabolotskaya, 749
  - two-dimensional, Schrödinger, nonlinear, of general form, 427
  - two-dimensional, Schrödinger, with cubic nonlinearity, 425
  - two-dimensional, Schrödinger, with power-law nonlinearity, 427
  - Tzitzéica, 541
  - unnormalized Boussinesq, 990
  - unnormalized Burgers, 187
  - unnormalized Kadomtsev–Petviashvili, 1002
  - unnormalized Korteweg–de Vries, 865
  - unnormalized modified Korteweg–de Vries, 870
  - variant of modified Burgers–Korteweg–de Vries, 886
  - vector Burgers, 417
  - Weber, 1193
  - Yermakov, 309, 518
- equations
- admitting variational form, 1595
  - algebraic, 1441
  - algebraic, with even powers, 1441
  - associativity, 972
  - axisymmetric steady laminar hydrodynamic boundary layer, 909
  - axisymmetric unsteady laminar boundary layer, 929
  - basic steps of Painlevé test, 1570
  - Bellman type, 805
  - Benney moment, 764
  - bilinear functional, 1775
  - boundary layer (Prandtl equations), 1333
  - elliptic, canonical form, 1392
  - evolution, canonic Bäcklund transformations, 1420
  - Chaplygin, 1202
  - Charpit, 1647, 1706
  - chromatography, 1231
  - cubic in derivatives, 134
  - Euler, 938, 1197, 1681, 1729
  - Euler, for barotropic gas flow, 1201
  - Euler, in Gromeka–Lamb form, 1201
  - Euler, in various coordinate systems, 1197

- equations (*continued*)
- evolution, nonlinear in second derivative, 346
  - exact methods, 1353
  - explicitly dependent on  $x$  and/or  $t$ , 266
  - fifth-order, 1031
  - first-order, quasilinear, 3
  - first-order, with three or more independent variables, 125
  - first-order, with two independent variables of general form, 99
  - first-order, with two independent variables quadratic in derivatives, 43
  - for convective fluid motions, 1329
  - fourth-order, 977
  - functional-differential, reducible to bilinear equation, 1776
  - Gelfand–Levitán–Marchenko type, 1584
  - heat, with power-law or exponential temperature-dependent thermal diffusivity, 409
  - heat and mass transfer, 697
  - heat and mass transfer, in quiescent or moving media with chemical reactions, 390
  - heat and mass transfer, with complicating factors, 734
  - hydrodynamic boundary layer, 903
  - hydrodynamic type, order reduction, 1422
  - hyperbolic, canonical form, 1390
  - invariance under scaling transformations, 1431
  - invariance under translations, 1429
  - involving arbitrary differential operators, 1101
  - involving arbitrary functions, 77, 279, 390, 499, 546, 682
  - involving arbitrary functions of derivatives, 113
  - involving arbitrary functions of four variables, 123
  - involving arbitrary functions of independent variables, 107
  - involving arbitrary functions of one variable, 19, 113
  - involving arbitrary functions of three variables, 120
  - involving arbitrary functions of two variables, 30, 116, 168
  - involving arbitrary parameters, 43, 540
  - involving arbitrary powers of derivatives, 102, 136
  - involving cosine, 276
  - involving cotangent, 278
  - involving derivatives in radicands, 101
  - involving exponential nonlinearities, 587
  - involving first derivative in  $t$ , 811, 857, 977
  - involving first derivative in  $t$  and linear in highest derivative, 1031
  - involving fourth powers of derivatives, 99
  - involving hyperbolic cosine, 268
  - involving hyperbolic cotangent, 270
  - involving hyperbolic sine, 269
  - involving hyperbolic tangent, 270
  - involving inverse trigonometric functions, 279
  - involving mixed derivatives, 1000, 1103
  - involving one arbitrary power of derivative, 107
  - involving power-law functions of derivatives, 156
  - involving power-law nonlinearities, 583
  - involving products of derivatives, 133
  - involving products of derivatives with respect to different variables, 131
  - involving roots and moduli of derivatives, 136
  - involving second derivative in  $t$ , 896, 987, 1088
  - involving second-order mixed derivatives, 949
  - involving sine, 277
  - involving squares of derivatives, 133
  - involving squares of one or two derivatives, 125
  - involving squares of three derivatives, 130
  - involving tangent, 278
  - involving third-order mixed derivatives, 958
  - involving two or more second derivatives, 839
  - involving two or three arbitrary powers of derivatives, 111
  - linear in mixed derivative, 745, 847
  - mathematical physics, Painlevé test, 1565
  - mathematical physics, transformations, 1395
  - Navier–Stokes, 1247
  - Navier–Stokes, general properties, 1249
  - Navier–Stokes, in Boussinesq approximation, 1329
  - Navier–Stokes, in various coordinate systems, 1247
  - nonlinear, diffusion boundary layer, 402
  - nonlinear, elliptic, geometrical models, 1754
  - nonlinear, elliptic, in two space dimensions, 1748
  - nonlinear, functional, containing complex argument, 1776
  - nonlinear, functional, reducible to bilinear, 1775
  - nonlinear, functional, solutions, 1496
  - nonlinear, in highest derivatives, 404
  - nonlinear, in two independent variables, 1392
  - nonlinear, involving arbitrary linear differential operators, 1065
  - nonlinear, involving arbitrary parameters, 99
  - nonlinear, of general form, 150, 169, 1392

- equations (*continued*)
- nonlinear, of thermal (diffusion) boundary layer, 346
  - nonlinear, parabolic, 1677, 1725
  - nonlinear, second-order, 1516
  - nonlinear, simple separation of variables, 1459
  - nonlinear, telegraph, with two space variables, 583
  - nonlinear, with arbitrary number of variables containing arbitrary functions, 162
  - nonlinear, with arbitrary number of variables containing arbitrary parameters, 158
  - nonlinear, with four independent variables, 154
  - nonlinear, with three variables containing arbitrary functions, 139
  - nonlinear, with three variables quadratic in derivatives, 125
  - nonstationary, 942
  - nonstationary, hydrodynamic (Navier–Stokes equations), 1013
  - nonstationary, of motion of viscous incompressible fluid, 1013
  - of atmospheric circulation in equatorial region, 1225
  - of breeze and monsoons, 1223
  - of Burgers and Korteweg–de Vries hierarchies, 1067
  - of dynamic convection in the sea, 1227
  - of flows in the baroclinic layer of the ocean, 1229
  - of general form, involving arbitrary functions of single argument, 358
  - of general form, involving arbitrary functions of two arguments, 362
  - of general form, involving first derivative in  $t$ , 1070
  - of heat and mass transfer in anisotropic media, 412
  - of higher orders, 1031
  - of ideal incompressible fluid, 942
  - of ideal plasticity, 1238
  - of mass transfer in quiescent or moving media with chemical reactions, 406
  - of motion of ideal fluid (Euler equations), 938, 1197
  - of nonlinear vibrations, stratified medium, 1131
  - of sixth- to ninth-order, 1039
  - of stationary transonic plane-parallel gas flow, 1122
  - of viscous incompressible fluid, 1003
  - ordinary differential, 1445
  - ordinary differential, Painlevé test, 1566
  - Painlevé, 1566
  - parabolic, canonical form, 1390
  - passing Painlevé test, 1572
  - Pfaffian, 1600
  - Pfaffian, not satisfying integrability condition, 1602
  - Plebański heavenly, 802
  - pseudo-differential, 1483, 1484
  - quadratic in derivatives, 139, 154, 158, 162
  - quadratic in highest derivatives, 772
  - quasilinear, 1393, 1647, 1649, 1707, 1708
  - quasilinear, discontinuous solutions, 1360
  - quasilinear, in conservative form, 1368
  - quasilinear, of general form, 1368
  - quasilinear, qualitative features, 1360
  - quasilinear, with  $n$  independent variables, 1356
  - reducible to Korteweg–de Vries equation, 875
  - second-order, classification, 1389
  - second-order, elliptic, with three or more space variables, 713
  - second-order, elliptic, with two space variables, 641
  - second-order, evolution, 1547
  - second-order, hyperbolic, 1551
  - second-order, hyperbolic, with one space variable, 433
  - second-order, hyperbolic, with two or more space variables, 553
  - second-order, involving mixed derivatives and some other, 745
  - second-order, involving real functions of real variables, 1165
  - second-order, nonlinear, for laser systems, 1170
  - second-order, of general form, 811, 1553
  - second-order, parabolic, with one space variable, 175
  - second-order, parabolic, with two or more space variables, 367
  - semilinear, in two independent variables, 1389
  - shallow water, 1124
  - stationary, 938
  - stationary, hydrodynamic (Navier–Stokes equations), 1003
  - steady boundary layer, for non-Newtonian fluids, 911
  - steady hydrodynamic boundary layer, 903
  - steady hydrodynamic boundary layer, for Newtonian fluid, 903
  - steady hydrodynamic boundary layer, symmetries, 1528
  - third-order, 857
  - three-argument, functional, 1497
  - three-dimensional, 1240
  - three-dimensional, involving arbitrary functions, 730
  - three-dimensional, of ideal plasticity, 1240
  - three and  $n$ -dimensional, 428
  - two-dimensional, 425, 1238
  - two-dimensional, Euler, for incompressible ideal fluid (plane flows), 1198

- equations (*continued*)
- unsteady boundary layer, for Newtonian fluid, 917
  - unsteady boundary layer, for non-Newtonian fluids, 930
  - von Kármán (fourth-order elliptic equations), 1192
  - with arbitrary dependence on derivatives, 148
  - with arbitrary number of independent variables, 39
  - with coefficients involving exponential functions, 11
  - with coefficients involving hyperbolic functions, 14
  - with coefficients involving logarithmic functions, 16
  - with coefficients involving power-law functions, 3
  - with coefficients involving trigonometric functions, 17
  - with cubic nonlinearities involving arbitrary functions, 355
  - with exponential nonlinearities, 254, 469, 662
  - with hyperbolic nonlinearities, 268, 485, 675
  - with logarithmic nonlinearities, 271, 388, 486, 677
  - with  $n$  independent variables, 739, 853
  - with  $n$  space variables, 417
  - with power-law nonlinearities, 175, 433, 641, 808
  - with power-law nonlinearity in derivatives, 161, 167
  - with power nonlinearity in derivatives, 146
  - with quadratic nonlinearities, 805, 896
  - with three independent variables, 35, 838
  - with three or more space variables, 406
  - with three or more space variables, involving arbitrary functions, 624
  - with three space variables, involving arbitrary parameters, 604
  - with three space variables, involving exponential nonlinearities, 722
  - with three space variables, involving power-law nonlinearities, 713
  - with trigonometric nonlinearities, 276, 389, 680
  - with two independent variables, 1355
  - with two independent variables, involving arbitrary functions, 19
  - with two independent variables, involving arbitrary parameters, 3
  - with two independent variables, nonlinear in two or more highest derivatives, 849
  - with two space variables, involving arbitrary functions, 589
  - with two space variables, involving exponential nonlinearities, 384, 574
  - with two space variables, involving power-law nonlinearities, 367, 553
  - error function, 187
  - errors in constructing solutions by symbolic computations, 1668
  - Euler equations, 938, 1197, 1681, 1729
    - for barotropic gas flow, 1201
    - in Gromeka–Lamb form, 1201
    - in various coordinate systems, 1197
  - Euler–Lagrange equation, 1595
  - Euler transformation, 122, 346, 769, 957, 1403, 1407
  - Eulerian coordinates, 1680, 1728
  - evaluation of function, 1628, 1740
  - evolution equations nonlinear in second derivative, 346
  - evolutionary conditions, 1616
  - exact methods for nonlinear partial differential equations, 1353
  - exact nonlinear problem, 1681, 1729
  - exact solutions of nonlinear partial differential equations, 1
  - exact solutions of various types of nonlinear PDEs, 1634
  - exact solutions with simple separation of variables, 1459
  - examples of constructing conservation laws using Noetherian symmetries, 1596
  - examples of constructing exact generalized separable solutions, 1467
  - examples of constructing exact solutions, 1503, 1534
  - examples of constructing functional separable solutions, 1492
  - examples of constructing invariant solutions to nonlinear equations, 1522
  - examples of constructing invariant solutions to nonlinear partial differential equations, 1451
  - examples of finding exact solutions of second- and third-order equations, 1465
  - examples of finding symmetries of nonlinear equations, 1516
  - examples of Lax pairs for nonlinear equations of mathematical physics, 1580
  - examples of self-similar solutions to mathematical physics equations, 1432
  - examples of solutions having movable singularities, 1565
  - examples of solutions of some specific functional equations, 1770, 1771
  - examples of solutions of specific functional equations, 1773
  - examples of solving Cauchy problem, 1381
  - examples of viscosity (nonsmooth) solutions, 1385
  - existence and uniqueness theorem, 1357, 1359, 1379, 1380
  - exp-function method, 1643, 1703
  - explicit central difference method, 1678, 1727, 1764

explicit finite difference scheme, 1761, 1763  
 explicit method, 1677, 1678, 1725, 1727  
 exponential isotherm, 1235  
 export facilities, 1751  
 external flow around cylinder, 1253

## F

Falkner–Skan problem, 907, 1334  
 false, 1739  
 fast diffusion, 251  
 fast diffusion equation, 211  
 fifth-order equations, 1031  
 file name, 1740  
 finding linear subspaces invariant under given nonlinear operator, 1480  
 finite element method, 1748  
 first hodograph transformation, 1399  
 first-order chemical reaction, 1135, 1137  
 first-order differential constraints, 1539  
   for PDEs, 1547  
 first-order equations  
   classification results, 1565  
   describing convective mass transfer with volume reaction, 1602  
   general solution, 1355  
   hydrodynamic type, involving three or more equations, 1197  
   in one unknown, overdetermined system, 1599  
   quasilinear, 3, 1355  
   nonlinear, 1373, 1659, 1719, 1720  
   nonlinear, methods for solving, 1373  
   nonlinear, with three or more independent variables, 125  
   nonlinear, with two independent variables of general form, 99  
   quasilinear, hyperbolic, 1607  
   quasilinear, methods for solving, 1355  
   solution, general, 1355  
   with three or more independent variables, 125  
   with two independent variables of general form, 99  
   with two independent variables quadratic in derivatives, 43  
 first-order hydrodynamic and other systems involving three or more equations, 1197  
 first-order hyperbolic systems of quasilinear equations, 1607  
 first-order nonlinear equations with three or more independent variables, 125  
 first-order nonlinear equations with two independent variables of general form, 99  
 first-order quasilinear equations, 3  
 first-order quasilinear partial differential equation, 1355  
 first Painlevé equation, 861, 989  
 first Stokes problem, 1251  
 Fisher equation, 176, 1639, 1699, 1744

FitzHugh–Nagumo equation, 179, 1746  
 fixed singularities of solutions, 1565  
 fKdV equation, 1034  
 flow  
   adiabatic nonisentropic gas, 1204  
   around cylinder, external, 1253  
   barotropic gas, Euler equations, 1201  
   Couette–Poiseuille plane, 1251  
   Ekman, 1282  
   Hagen–Poiseuille, 1253  
   Homann, 1302  
   in confuser, 1261  
   in diffuser, 1261  
   in rotating layer, 1283  
   irrotational gas, 1201  
   Jeffery–Hammel, 1260  
   Kármán, 1290  
   one-dimensional, compressible gas, 768  
   one-dimensional, polytropic ideal gas, 1125  
   potential, 1334  
   potential gas, 1201  
   quasi-plane, 1285  
   stationary transonic plane-parallel gas, 1122  
   steady transonic gas, 657  
   von Kármán, 1290  
 flows  
   axial, 1303  
   axisymmetric, 1274  
   conical vortex, 1290  
   cylindrical vortex, 1290  
   generalized Couette–Poiseuille plane, 1329  
   in baroclinic layer of ocean, 1229  
   one-dimensional barotropic, ideal compressible gas, 1127  
   one-dimensional rotation fluid, 1257  
   plane, two-dimensional Euler equations for incompressible ideal fluid, 1198  
   plane, two-dimensional solutions in cylindrical coordinates, 1270  
   plane, two-dimensional solutions in rectangular Cartesian coordinates, 1263  
   plane, unidirectional, 1251  
   quasi-plane, 1285  
   three-dimensional stagnation-point type, 1302  
   unidirectional, in tubes of various cross-sections, 1253  
   unidirectional, plane, 1251  
   unsteady transonic gas, 756  
   von Kármán-type rotationally symmetric, 1316  
   with two-nonzero velocity components, 1282  
 fluid streamlines, 1253, 1257  
 Fokas–Yortsos equation, 237  
 forward difference method, 1677, 1725, 1761  
 forward time backward space method, 1676  
 fourth-order equations, 977  
 fourth-order Liouville type equation, 1030

- fourth Painlevé equation, 988  
 front end, 1688  
 Fuchs index, 1570  
 Fuchs indices, 1567, 1568, 1570  
 Fujita–Storm equation, 212  
 function  
   error, 187  
   handle, 1741  
   Jacobi elliptic, 990  
   mathematical library, 1736  
   m-files, 1737  
   modified Bessel, 1260  
   name of, 1740  
 functional-differential equations reducible to  
   bilinear equation, 1776  
 functional equation, 1498, 1500, 1767, 1769  
   describing traveling-wave solutions, 1431  
   Pexider, 1771  
 functional equations  
   bilinear, 1775  
   nonlinear, containing complex argument,  
     1776  
   nonlinear, reducible to bilinear, 1775  
   nonlinear, solutions, 1496  
 functional separable solutions, 1487, 1652,  
   1711  
 functional separation of variables, 1655,  
   1715  
 functional separation of variables by  
   differentiation, 1656, 1716  
 functions  
   active functions, 1628  
   anonymous, 1741  
   Bessel, 1160, 1255, 1259  
   built-in, 1740  
   inert, 1628  
   Kelvin, 1256  
   nested, 1741  
   predefined, 1628, 1740  
   pure, 1690  
   special, 1740  
   written in m-files, 1740
- G**
- Galileo transformation, 1514  
 Gardner equation, 871  
 gas dynamic type systems linearizable with  
   hodograph transformation, 1122  
 Gauss equation, 1772  
 Gelfand–Levitan–Marchenko integral  
   equation, 863, 868, 990, 1002  
 Gelfand–Levitan–Marchenko type integral  
   equations, 1584  
 general consistency method for two  
   equations, 1542  
 general description of method of differential  
   constraints, 1546  
 general fifth-order KdV equation, 1034  
 general form  
   equations involving first derivative  
   in  $t$ , 1070  
   for symmetry reduction, 1506  
   of conservation laws, 1593  
   of contact transformations for partial  
     differential equations, 1405  
   of functional differential equations, 1464  
   of point transformations, 1395  
   of self-similar solutions, 1431  
   of solutions, 1464  
   of traveling-wave solutions, 1429  
 general integral, 1373, 1374  
 general properties of Navier–Stokes  
   equations, 1249  
 general scheme  
   for analysis of nonlinear partial differential  
     equations, 1570  
   for constructing generalized traveling-wave  
     solutions, 1489  
   of using invariants for solving mathemati-  
     cal equations, 1439, 1440  
 general solution  
   of characteristic system, 1355  
   of first-order PDE, 1355  
 generalizations to pseudo-differential  
   equations, 1483  
 generalized Blasius problem, 912  
 generalized Burgers equation, 288  
 generalized Burgers–Korteweg–de Vries  
   equation, 1045, 1503  
 generalized Calogero equation, 748  
 generalized Cauchy problem, 1649, 1650,  
   1708, 1709  
 generalized classical method of characteris-  
   tics, 1385  
 generalized Couette–Poiseuille plane  
   flows, 1329  
 generalized Emden–Fowler equation, 327,  
   477, 511, 512, 513, 516, 527, 528, 697,  
   698  
 generalized Falkner–Skan problem, 914  
 generalized Kadomtsev–Petviashvili equation,  
   1029  
 generalized Khokhlov–Zabolotskaya  
   equation, 751  
 generalized Korteweg–de Vries equation,  
   871  
 generalized Kuramoto–Sivashinsky equation,  
   983  
 generalized Landau–Ginzburg equation, 360  
 generalized Langmuir isotherm, 1233  
 generalized Liouville equation, 1108  
 generalized method of characteristics, 1647,  
   1650, 1709  
 generalized porous medium equation with  
   nonlinear source, 340  
 generalized reciprocal polynomial equation,  
   1443  
 generalized Schlichting problem, 912  
 generalized self-similar solutions, 1436  
 generalized separable solutions, 1464, 1620,  
   1652, 1654, 1711, 1714

generalized separable solutions (*continued*)  
 by differentiation,  $n$ th-order nonlinear PDE, 1652, 1711  
 by splitting, 1653, 1712  
 generalized solution, 1364  
 generalized traveling-wave solutions, 1487  
 generalized viscosity solutions and their applications, 1382  
 generalized/functional separation of variables vs. differential constraints, 1561  
 generalizing exact solutions, 1665  
 generic system, 1754  
 geometry description matrix, 1755  
 Gibbons–Tsarev equation, 764  
 global variables, 1739  
 Goursat equation, 549  
 Grad–Shafranov equation, 678, 691  
 graphical user interface, 1736, 1748  
 graphical user interface development environment, 1738  
 graphics system, 1736  
 group generator, 1514, 1526  
 group invariants, 1526

## H

Hagen–Poiseuille flow, 1253  
 Hamilton–Jacobi equation, 1379  
 Hamiltonian, 1379  
 Harry Dym equation, 878  
 heat and mass transfer equations, 697, 730  
 in quiescent or moving media with chemical reactions, 390  
 with complicating factors, 734  
 heat equations with power-law or exponential temperature-dependent thermal diffusivity, 409  
 Hele–Shaw cell, 984  
 Helmholtz equation, 380, 397, 399, 420, 423, 558, 570, 601, 938, 1289  
 Henry coefficients, 1231  
 Hiemenz problem, 1264  
 higher-order differential constraints, 1555  
 Hill vortex, 1278  
 hodograph transformation, 35, 212, 344, 1129, 1397  
 Homann flow, 1302  
 homogeneous Monge–Ampère equation, 775, 1430  
 Hopf–Cole transformation, 187, 888, 1067, 1409, 1414  
 Hopf equation, 5  
 Hopf formula for generalized solution, 1366  
 Hunter–Saxton equation, 745  
 hydrodynamic-type system of diagonal form, 1236  
 hydrodynamic-type system of nondiagonal form, 1236  
 hydrodynamic boundary layer equation with pressure gradient, 907  
 hydrodynamic boundary layer equations, 903

hyperbolic equation  
 first canonical form, 1391  
 second canonical form, 1392  
 hyperbolic  $n \times n$  systems of conservation laws, 1614  
 hyperbolic sine-Gordon equation, 485  
 hyperbolic system, 1607, 1608, 1615  
 hypergeometric equation, 1012

## I

ideal (inviscid) fluid, 938, 1197  
 ideal plasticity with von Mises yield criterion, 1238  
 implicit form of solution, 1648, 1708  
 incorrect response, 1626, 1688, 1737  
 inert functions, 1628  
 infinitesimal generator, 1514  
 infinitesimal operator, 1513, 1514, 1526  
 initial value problem, 1383, 1611  
 integral equation  
 Gelfand–Levitan–Marchenko, 863, 868, 990, 1002  
 Gelfand–Levitan–Marchenko type, 1584  
 integrals of motion, 1593  
 integrating factor of Pfaffian equation, 1601  
 introducing and removing additional arbitrary constants, 1666  
 invariance condition, 1516, 1527, 1595  
 invariance of equations under scaling transformations, 1431  
 invariance of equations under translations, 1429  
 invariance of solutions and equations under translation transformations, 1430  
 invariant, 1439, 1445, 1450, 1526  
 determination procedure, 1446  
 of group, 1526  
 of infinitesimal operator, 1514  
 of operator, 1514, 1526  
 of transformation, 1440  
 invariant condition, 1527  
 invariant solution, 1431, 1435, 1451, 1513, 1520, 1527, 1602, 1620  
 invariant surface condition, 1533  
 inverse problems, 1455  
 inverse scattering method, 990, 1002  
 inverse scattering problem, 1587  
 inviscid Burgers equation, 1674, 1763  
 explicit method, 1678, 1725  
 initial value problem, 1762  
 shock waves and rarefaction waves, 1757  
 shock waves and weak solutions, 1759  
 irrotational gas flow, 1201  
 isotherms of adsorption, 1231  
 Ito equation, 1037

## J

Jacobi elliptic function, 990  
 Jacobi–Mayer bracket, 1377  
 Jacobian elliptic cosine, 858



Jeffery–Hamel flow, 1260  
 Jeffery–Hamel problem, 1261  
 Jeffery–Hamel solution, 1272  
 jet-source problem, 1335  
 jump condition, 1362, 1363, 1369

## K

Kármán–Howarth equation, 253  
 Kadomtsev–Petviashvili equation, 1587  
   in canonical form, 1000  
   related equations, 1000  
 Kadomtsev–Petviashvili type equation, 1002  
 Kaup–Kupershmidt equation, 1036  
 Kawahara equation, 1032  
 KdV equation, 857  
 Kelvin functions, 1256  
 Khokhlov–Zabolotskaya and related equations, 749  
 kinematic momentum, 1335  
 kinematic viscosity, 1247  
 kink, 1636, 1695  
 KK equation, 1036  
 Klein–Gordon equation, 1641, 1656, 1701, 1716  
 $k(n, n)$  equation, 891  
 Kolmogorov–Petrovskii–Piskunov (KPP) equation, 279, 1633, 1694  
 Kolmogorov model, 1006  
 Korteweg–de Vries–Burgers equation, 884  
 Korteweg–de Vries equation, 857, 1574, 1580, 1583, 1638, 1698  
   in canonical form, 857  
 Korteweg–de Vries type equation  
   with exponential nonlinearity, 874  
   with logarithmic nonlinearity, 874  
   with power-law nonlinearity, 872  
 Kovalevskaya–Painlevé test, 1569  
 KPP-type equation, 1633, 1694  
 Kuramoto–Sivashinsky equation, 982

## L

Lagrange–Charpit method, 1376  
 Lagrangian, 1595  
 Lagrangian coordinates, 1680, 1728  
 laminar fluid flows, 1247  
 Landau problem, 1012  
 Landau solution, 1277  
 Langmuir isotherm, 1231  
 Laplace equation, 394, 409, 421, 556, 558, 579, 646, 938, 1392  
 law of conservation of mass, 1610  
 Lax condition, 1616, 1617  
 Lax equation, 1035, 1068  
   with forcing term, 1037  
 Lax method, 1678, 1726, 1763  
 Lax pair, 1579  
 leading terms of equation, 1567  
 Legendre transformation, 122, 767, 768, 770, 1403, 1406  
   with many variables, 1408

library functions, 1628, 1740  
 Lie group, 1526  
 limiting self-similar solution, 1454, 1456  
 Lin–Reissner–Tsien equation, 756, 759  
 linear determining equation, 1556, 1557  
 linear heat equation, 807, 1252  
 linear Schrödinger equation, 865, 1186  
 linear subspaces invariant under nonlinear operator, 1477  
 linear transformations, 1396  
 linear wave equation, 1392  
 linearization of systems of gas dynamic type by hodograph transformation, 1610  
 Liouville equation, 144, 165, 470, 540, 1117, 1414  
 lists, 1629, 1691  
 local structure of generalized viscosity solutions, 1383  
 local transformations of derivatives, 1526  
 local variables, 1739  
 logical expression, 1739  
 logical operators, 1628, 1689, 1738  
 Loitsianskii decay law, 253  
 Lorentz transformation, 1514  
 Lotka–Volterra system, 1135

## M

m-file, 1737  
 Mach angle, 1203  
 Mach number, 757  
 main program, 1737  
 Maple language, 1627  
 Maple worksheets, 1626  
 Maplet applications, 1627  
 Maplet user interface, 1627  
 Martin transformation, 775  
 Mathematica language, 1689  
 Mathematica objects, 1691  
 mathematical constants, 1690  
 mathematical function library, 1736  
 Mathlink, 1688  
 MATLAB language, 1738  
 matrix, 1629, 1691, 1741  
 mesh, 1677, 1725  
 mesh points, 1677, 1725  
 method  
   based on compatibility condition for systems of linear equations, 1581  
   based on linear integral equations, 1584  
   based on using Lax pairs, 1579  
   classical, of separation of variables, 1651, 1711  
   classical, of symmetry reductions, 1513  
   Clarkson–Kruskal direct, 1503  
   differentiation, 1492  
   direct, of symmetry reductions and differential constraints, 1562  
   direct, of symmetry reductions of nonlinear equations, 1503  
   exp-function, 1643, 1703

- method (*continued*)
- explicit, 1677, 1678, 1725, 1727
  - explicit central difference, 1678, 1727, 1764
  - finite element, 1748
  - for constructing stable generalized solutions, 1370
  - forward difference, 1677, 1725, 1761
  - forward time backward space, 1676
  - general consistency for two equations, 1542
  - inverse scattering, 990, 1002
  - inverse scattering, Cauchy problem, 1587
  - inverse scattering, Cauchy problem for nonlinear equations, 1589
  - Lagrange–Charpit, 1376
  - Lax, 1678, 1726, 1763
  - of argument elimination by test functions, 1772
  - of characteristics, 32, 35, 1355–1357, 1647, 1649, 1707, 1708, 1756
  - of characteristics, generalized, 1385, 1647, 1650, 1709
  - of conversion to equivalent system of equations, 1398
  - of differential constraints, 1539
  - of differential constraints, general description, 1546
  - of differential constraints for ordinary differential equations, 1539
  - of differentiation in independent variables, 1771
  - of differentiation in parameter, 1769
  - of functional separation of variables, 1487
  - of generalized separation of variables, 1459
  - of invariants, 1439
  - of lines, 1722, 1743
  - of separation of variables, 1374
  - of symmetry reductions, nonclassical, 1533, 1562
  - of vanishing viscosity, 1366, 1383
  - similarity, 1431
  - sine-cosine, 1642, 1702
  - specifying single-stage numerical, 1674, 1676
  - specifying two-stage numerical, startup method, 1676
  - spectral collocation, 1680, 1729
  - splitting, 1496
  - tanh-coth, 1641, 1701
  - Titov–Galaktionov, 1477
- methods
- exact, for nonlinear partial differential equations, 1353
  - for constructing traveling-wave solutions, 1641, 1700
  - for solving first-order nonlinear equations, 1373
  - for solving first-order quasilinear equations, 1355
  - numerical and graphical, 1672
  - numerical, embedded in Maple, 1674
  - of inverse scattering problem (soliton theory), 1579
  - Miura transformation, 862, 868, 1410
  - mKdV equation, 867
  - model equation for dynamics of nonlinear strings, 534
  - model equation of gas dynamics, 5, 25, 1360
  - model equation of nonlinear waves with damping, 6
  - modification of coupled KdV equation, 1172
  - modified  $k(n, n)$  equation, 892
  - modified Bessel function, 1260
  - modified Burgers equation, 191
  - modified Burgers–Korteweg–de Vries equation, 886
  - modified Harry Dym equation, 891
  - modified Korteweg–de Vries–Burgers equation, 886
  - modified Korteweg–de Vries equation, 862, 866, 869, 1583
  - in canonical form, 867
  - module, 1629, 1691
  - module system, 1741
  - Monge–Ampère equation, 774, 1393
  - Monge cone, 1647, 1706
  - movable singularities of solutions, 1565
  - of ordinary differential equations, 1565
  - $m$ th prolongation of group generator, 1527
  - multipeakon solutions, 968
  - multiple statements in line, 1739
  - multiplicative separable solution, 1374, 1459, 1651, 1710
- ## N
- $n$ -dimensional modified Schrödinger equation with cubic nonlinearity, 431
  - $n$ -dimensional Schrödinger equation with cubic nonlinearity, 430
  - $n$ -soliton solution, 859, 1591
  - of Korteweg–de Vries equation, 1591
  - Nadai multiplicative separable solution, 1238
  - Nadai solution, 1238
  - name of symbol, 1689, 1690
  - Navier–Stokes equations, 1247
  - general properties, 1249
  - in Boussinesq approximation, 1329
  - nonstationary, 1013
  - stationary hydrodynamic, 1003
  - nested functions, 1741
  - nested lists, 1691
  - Newell–Whitehead equation, 1534
  - Newtonian fluid, 1247
  - Nijenhuis tensor, 1237
  - ninth-order KdV-type equation, 1041
  - no-slip condition, 1253
  - Noetherian symmetry, 1595

- non-Newtonian fluid, 911, 932, 933  
   boundary layer equations, 915  
   of general form, 915  
 nonclassical hodograph transformation, 345, 1399  
 nonclassical method of symmetry reductions, 1533  
 nonclassical method of symmetry reductions and differential constraints, 1562  
 nonclassical self-similar solution, 500, 685, 689, 1435  
 nonclassical symmetries, 1533  
 nonclassical traveling-wave solution, 679, 690, 706  
 noninvariant self-similar solution, 1435  
 nonlinear diffusion boundary layer equations, 402  
 nonlinear diffusion equation, 1645, 1705  
   with cubic source, 1577  
 nonlinear dispersive nondissipative waves, 857  
 nonlinear elliptic PDEs (geometrical models), 1754  
 nonlinear elliptic PDEs in two space dimensions, 1748  
 nonlinear equation  
   adiabatic, 1262  
   BBM, 958  
   Bernoulli, 394, 421  
   Born–Infeld, 766, 1401  
   boundary layer, for non-Newtonian fluid, 917  
   boundary layer, for power-law fluid with pressure gradient, 913  
   Boussinesq, 368, 987, 1504  
   Boussinesq, in canonical form, 987  
   Boussinesq-type, 1028  
   breaking soliton, 1030  
   Burgers, 186, 1409, 1414, 1572, 1637, 1673, 1677, 1697, 1723, 1725, 1743, 1761  
   Burgers–Huxley, 189  
   Burgers–Korteweg–de Vries, 884  
   Calogero, 745, 746  
   Calogero-type, 1400  
   Camassa–Holm, 968  
   Chaplygin, 765  
   characteristic, 1389, 1393, 1647, 1706  
   Clairaut, 118, 152, 172, 1375  
   Clairaut, in implicit form, 122  
   combined KdV–mKdV, 871  
   complete Lin–Reissner–Tsien, 757  
   cylindric Burgers, 191  
   cylindrical Korteweg–de Vries, 866  
   Degasperis–Procesi, 968  
   diffusion, 1645, 1705  
   diffusion, with cubic source, 1577  
   double sine-Gordon, 492  
   double sinh-Gordon, 485  
   Dym, 878  
   elliptic, 1392  
   Emden–Fowler, 248, 442, 444, 447, 462, 464, 647, 648, 655  
   Enneper, 491  
   Euler–Lagrange, 1595  
   evolution, nonlinear in second derivative, 346  
   fast diffusion, 211  
   first-order, 1355, 1373  
   first Painlevé, 861, 989  
   Fisher, 176, 1639, 1699, 1744  
   FitzHugh–Nagumo, 179, 1746  
   fKdV, 1034  
   Fokas–Yortsos, 237  
   fourth-order, Liouville type, 1030  
   fourth Painlevé, 988  
   Fujita–Storm, 212  
   Gardner, 871  
   Gauss, 1772  
   general fifth-order KdV, 1034  
   generalized Burgers–Korteweg–de Vries, 1045, 1503  
   generalized Burgers, 288  
   generalized Calogero, 748  
   generalized Emden–Fowler, 327, 477, 511, 512, 513, 516, 527, 528, 697, 698  
   generalized Kadomtsev–Petviashvili, 1029  
   generalized Khokhlov–Zabolotskaya, 751  
   generalized Korteweg–de Vries, 871  
   generalized Kuramoto–Sivashinsky, 983  
   generalized Landau–Ginzburg, 360  
   generalized Liouville, 1108  
   Gibbons–Tsarev, 764  
   Goursat, 549  
   Grad–Shafranov, 678, 691  
   Hamilton–Jacobi, 1379  
   Hamilton–Jacobi, Cauchy problem, 1380  
   Harry Dym, 878  
   homogeneous Monge–Ampère, 775, 1430  
   Hopf, 5  
   Hunter–Saxton, 745  
   hydrodynamic boundary layer, with pressure gradient, 907  
   hyperbolic, first canonical form, 1391  
   hyperbolic, second canonical form, 1392  
   hypergeometric, 1012  
   inviscid Burgers, 1674, 1763  
   inviscid Burgers, explicit method, 1678, 1725  
   inviscid Burgers, initial value problem, 1762  
   inviscid Burgers, shock waves and rarefaction waves, 1757  
   inviscid Burgers, shock waves and weak solutions, 1759  
   Ito, 1037  
    $k(n, n)$ , 891  
   Kadomtsev–Petviashvili, 1000, 1587  
   Kadomtsev–Petviashvili, in canonical form, 1000  
   Kadomtsev–Petviashvili type, 1002  
   Kármán–Howarth, 253  
   Kaup–Kupershmidt, 1036

- nonlinear equation (*continued*)
- Kawahara, 1032
  - KdV, 857
  - Khokhlov–Zabolotskaya, 749
  - KK, 1036
  - Klein–Gordon, 499, 1494, 1641, 1656, 1701, 1716
  - Kolmogorov type, 377, 398
  - Kolmogorov–Petrovskii–Piskunov (KPP), 279, 1633, 1694
  - Korteweg–de Vries, 857, 1574, 1580, 1583, 1638, 1698
  - Korteweg–de Vries, in canonical form, 857
  - Korteweg–de Vries–Burgers, 884
  - Korteweg–de Vries type, with exponential nonlinearity, 874
  - Korteweg–de Vries type, with logarithmic nonlinearity, 874
  - Korteweg–de Vries type, with power-law nonlinearity, 872
  - KPP-type, 1633, 1694
  - Kuramoto–Sivashinsky, 982
  - Lax, 1035, 1068
  - Lax, with forcing term, 1037
  - Lin–Reissner–Tsien, 756, 759
  - Liouville, 144, 165, 470, 540, 1117, 1414
  - mKdV, 867
  - model, for dynamics of nonlinear strings, 534
  - model, of gas dynamics, 5, 25, 1360
  - model, of nonlinear waves with damping, 6
  - modification of coupled KdV, 1172
  - modified Burgers, 191
  - modified Burgers–Korteweg–de Vries, 886
  - modified Harry Dym, 891
  - modified  $k(n, n)$ , 892
  - modified Korteweg–de Vries, 862, 866, 869, 1583
  - modified Korteweg–de Vries–Burgers, 886
  - modified Korteweg–de Vries, in canonical form, 867
  - Monge–Ampère, 774, 1393
  - of axisymmetric steady hydrodynamic boundary layer, 1508
  - of Burgers hierarchy, 1067
  - of complete Korteweg–de Vries hierarchy, 1069
  - of helical surface, 8
  - of Korteweg–de Vries hierarchy, 1068
  - of light rays, 63
  - of minimal surfaces, 768, 1597
  - of modified Korteweg–de Vries hierarchy, 1069
  - of steady transonic gas flow, 657
  - of surface of bodies of revolution, 8
  - of unsteady transonic gas flows, 756
  - one-soliton solution, mKdV, 867
  - one-soliton solution, potential KdV, 876
  - Ostrovsky, 968
  - $n$ -dimensional modified Schrödinger, with cubic nonlinearity, 431
  - $n$ -dimensional Schrödinger, with cubic nonlinearity, 430
  - Newell–Whitehead, 1534
  - ninth-order KdV-type, 1041
  - $n$ th-order Liouville type, 1109
  - palindromic, 1442
  - Pfaffian, 1600
  - Pfaffian, condition for integrability by single relation, 1601
  - Plebański first heavenly, 802
  - Plebański second heavenly, 803
  - Poisson, 1679, 1727, 1750
  - Poisson–Boltzmann, 1755
  - porous medium, 210
  - potential, of one-dimensional flow of compressible gas, 768
  - potential Korteweg–de Vries (KdV), 876
  - potential modified Korteweg–de Vries (mKdV), 877
  - Rayleigh–Zababakhin–Plesset, 1262
  - Riccati, 140, 142, 162, 164, 423, 425, 453, 482, 520, 1012, 1277
  - Sawada–Kotera, 1035
  - Sawada–Kotera, with forcing term, 1038
  - Schrödinger, 348, 425, 1582
  - Schrödinger, of general form, 358, 360, 363, 364
  - Schrödinger, with cubic nonlinearity, 348, 350, 351, 352, 355
  - Schrödinger, with power-law nonlinearity, 351, 353
  - Schwarzian Korteweg–de Vries, 870
  - second Painlevé, 861, 867, 988, 989
  - seventh-order KdV-type, 1040
  - Sharm–Tasso–Olver, 887, 1067
  - sine-Gordon, 485, 490, 543, 1117, 1635, 1639, 1646, 1695, 1698, 1706
  - sinh-Gordon, 485, 542, 1580
  - SK, 1035
  - spherical Korteweg–de Vries, 866
  - stationary heat, with nonlinear source, 682
  - stationary Khokhlov–Zabolotskaya, 649
  - telegraph, 494, 538, 583, 585
  - thin film, 985
  - third-order Liouville type, 972
  - Thomas, 544
  - three-dimensional Khokhlov–Zabolotskaya, 752
  - three-dimensional Schrödinger, of general form, 429
  - three-dimensional Schrödinger, with cubic nonlinearity, 428
  - tractrix, 253
  - Tricomi, 659
  - two-dimensional Khokhlov–Zabolotskaya, 749
  - two-dimensional Schrödinger, of general form, 427
  - two-dimensional Schrödinger, with cubic nonlinearity, 425

- nonlinear equation (*continued*)  
 two-dimensional Schrödinger, with  
 power-law nonlinearity, 427  
 Tzitzéica, 541  
 unnormalized Boussinesq, 990  
 unnormalized Burgers, 187  
 unnormalized Kadomtsev–Petviashvili,  
 1002  
 unnormalized Korteweg–de Vries, 865  
 unnormalized modified Korteweg–de  
 Vries, 870  
 variant of modified Burgers–Korteweg–de  
 Vries, 886  
 vector Burgers, 417  
 wave, 1400, 1519, 1536, 1673, 1678, 1723,  
 1727, 1764  
 Weber, 1193  
 Yermakov, 309, 518
- nonlinear equations  
 admitting variational form, 1595  
 algebraic, 1441  
 algebraic, with even powers, 1441  
 axisymmetric steady laminar hydrodynamic  
 boundary layer, 909  
 axisymmetric unsteady laminar boundary  
 layer, 929  
 basic steps of Painlevé test, 1570  
 Bellman type, 805  
 Benney moment, 764  
 boundary layer (Prandtl equations), 1333  
 evolution, canonic Bäcklund transforma-  
 tions, 1420  
 Chaplygin, 1202  
 Charpit, 1647, 1706  
 chromatography, 1231  
 cubic in derivatives, 134  
 diffusion boundary layer, 402  
 elliptic, geometrical models, 1754  
 elliptic, in two space dimensions, 1748  
 Euler, 938, 1197, 1681, 1729  
 Euler, for barotropic gas flow, 1201  
 Euler, in Gromeka–Lamb form, 1201  
 Euler, in various coordinate systems, 1197  
 evolution, nonlinear in second derivative,  
 346  
 exact methods, 1353  
 explicitly dependent on  $x$  and/or  $t$ , 266  
 fifth-order, 1031  
 first-order with three or more independent  
 variables, 125  
 first-order with two independent variables  
 of general form, 99  
 first-order with two independent variables  
 quadratic in derivatives, 43  
 for convective fluid motions, 1329  
 fourth-order, 977  
 functional, containing complex argument,  
 1776  
 functional, reducible to bilinear, 1775  
 functional, solutions, 1496  
 functional-differential, 1776  
 heat and mass transfer, 697  
 heat and mass transfer, in quiescent  
 or moving media with chemical  
 reactions, 390  
 heat and mass transfer, with complicating  
 factors, 734  
 heat, with power-law or exponential  
 temperature-dependent thermal  
 diffusivity, 409  
 hydrodynamic boundary layer, 903  
 hydrodynamic type, order reduction, 1422  
 hyperbolic, canonical form, 1390  
 hyperbolic, first canonical form, 1391  
 hyperbolic, second canonical form, 1392  
 in highest derivatives, 404  
 in two independent variables, 1392  
 invariance under scaling transformations,  
 1431  
 invariance under translations, 1429  
 involving arbitrary differential operators,  
 1101  
 involving arbitrary functions, 77, 279, 390,  
 499, 546, 682  
 involving arbitrary functions of derivatives,  
 113  
 involving arbitrary functions of four  
 variables, 123  
 involving arbitrary functions of indepen-  
 dent variables, 107  
 involving arbitrary functions of one  
 variable, 19, 113  
 involving arbitrary functions of three  
 variables, 120  
 involving arbitrary functions of two  
 variables, 30, 116, 168  
 involving arbitrary linear differential  
 operators, 1065  
 involving arbitrary parameters, 43, 99, 540  
 involving arbitrary powers of derivatives,  
 102, 136  
 involving cosine, 276  
 involving cotangent, 278  
 involving derivatives in radicands, 101  
 involving exponential nonlinearities, 587  
 involving first derivative in  $t$ , 811, 857,  
 977  
 involving first derivative in  $t$  and linear in  
 highest derivative, 1031  
 involving fourth powers of derivatives, 99  
 involving hyperbolic cosine, 268  
 involving hyperbolic cotangent, 270  
 involving hyperbolic sine, 269  
 involving hyperbolic tangent, 270  
 involving inverse trigonometric functions,  
 279  
 involving mixed derivatives, 1000, 1103  
 involving one arbitrary power of derivative,  
 107  
 involving power-law functions of  
 derivatives, 156  
 involving power-law nonlinearities, 583

- nonlinear equations (*continued*)
- involving products of derivatives, 133
  - involving products of derivatives with respect to different variables, 131
  - involving roots and moduli of derivatives, 136
  - involving second-order mixed derivatives, 949
  - involving second derivative in  $t$ , 896, 987, 1088
  - involving sine, 277
  - involving squares of derivatives, 133
  - involving squares of one or two derivatives, 125
  - involving squares of three derivatives, 130
  - involving tangent, 278
  - involving third-order mixed derivatives, 958
  - involving two or more second derivatives, 839
  - involving two or three arbitrary powers of derivatives, 111
  - linear in mixed derivative, 745, 847
  - mathematical physics, Painlevé test, 1565
  - mathematical physics, transformations, 1395
  - Navier–Stokes, 1247
  - Navier–Stokes, general properties, 1249
  - Navier–Stokes, in Boussinesq approximation, 1329
  - Navier–Stokes, in various coordinate systems, 1247
  - nonstationary, 942
  - nonstationary, hydrodynamic (Navier–Stokes equations), 1013
  - nonstationary, of motion of viscous incompressible fluid, 1013
  - of atmospheric circulation in equatorial region, 1225
  - of breeze and monsoons, 1223
  - of Burgers hierarchies, 1067
  - of diffusion (thermal) boundary layer, 346
  - of dynamic convection in the sea, 1227
  - of flows in the baroclinic layer of the ocean, 1229
  - of general form, 150, 169, 1392
  - of general form, involving arbitrary functions of single argument, 358
  - of general form, involving arbitrary functions of two arguments, 362
  - of general form, involving first derivative in  $t$ , 1070
  - of heat and mass transfer in anisotropic media, 412
  - of higher orders, 1031
  - of ideal incompressible fluid, 942
  - of ideal plasticity, 1238
  - of Korteweg–de Vries hierarchies, 1067
  - of mass transfer in quiescent or moving media with chemical reactions, 406
  - of motion of ideal fluid (Euler equations), 938, 1197
  - of sixth- to ninth-order, 1039
  - of stationary transonic plane-parallel gas flow, 1122
  - of thermal (diffusion) boundary layer, 346
  - of vibrations, of stratified medium, 1131
  - of viscous incompressible fluid, 1003
  - ordinary differential, 1445
  - ordinary differential, Painlevé test, 1566
  - Painlevé, 1566
  - parabolic, 1677, 1725
  - parabolic, canonical form, 1390
  - passing Painlevé test, 1572
  - Pfaffian, 1600
  - Pfaffian, not satisfying integrability condition, 1602
  - Plebański heavenly, 802
  - quadratic in derivatives, 139, 154, 158, 162
  - quadratic in highest derivatives, 772
  - reducible to Korteweg–de Vries equation, 875
  - second-order, classification, 1389
  - second-order, elliptic, with three or more space variables, 713
  - second-order, elliptic, with two space variables, 641
  - second-order, evolution, 1547
  - second-order, hyperbolic, 1551
  - second-order, hyperbolic, with one space variable, 433
  - second-order, hyperbolic, with two or more space variables, 553
  - second-order, involving mixed derivatives and some other, 745
  - second-order, involving real functions of real variables, 1165
  - second-order, nonlinear, for laser systems, 1170
  - second-order, of general form, 811, 1553
  - second-order, parabolic, with one space variable, 175
  - second-order, parabolic, with two or more space variables, 367
  - semilinear, in two independent variables, 1389
  - shallow water, 1124
  - simple separation of variables, 1459
  - stationary, 938
  - stationary hydrodynamic (Navier–Stokes equations), 1003
  - steady boundary layer, for non-Newtonian fluids, 911
  - steady hydrodynamic boundary layer, for Newtonian fluid, 903
  - steady hydrodynamic boundary layer, symmetries, 1528
  - steady-state hydrodynamic boundary layer, 903
  - telegraph, with two space variables, 583
  - third-order, 857
  - three- and  $n$ -dimensional, 428

- nonlinear equations (*continued*)
- three-argument functional, 1497
  - three-dimensional, 1240
  - three-dimensional, involving arbitrary functions, 730
  - three-dimensional, of ideal plasticity, 1240
  - two-dimensional, 425, 1238
  - two-dimensional Euler, for incompressible ideal fluid (plane flows), 1198
  - unsteady boundary layer, for Newtonian fluid, 917
  - unsteady boundary layer, for non-Newtonian fluids, 930
  - von Kármán (fourth-order elliptic equations), 1192
  - with arbitrary dependence on derivatives, 148
  - with arbitrary number of independent variables, 39
  - with arbitrary number of variables, involving arbitrary functions, 162
  - with arbitrary number of variables, involving arbitrary parameters, 158
  - with coefficients involving exponential functions, 11
  - with coefficients involving hyperbolic functions, 14
  - with coefficients involving logarithmic functions, 16
  - with coefficients involving power-law functions, 3
  - with coefficients involving trigonometric functions, 17
  - with cubic nonlinearities involving arbitrary functions, 355
  - with exponential nonlinearities, 254, 469, 662
  - with four independent variables, 154
  - with hyperbolic nonlinearities, 268, 485, 675
  - with logarithmic nonlinearities, 271, 388, 486, 677
  - with  $n$  independent variables, 739, 853
  - with  $n$  space variables, 417
  - with power-law nonlinearities, 175, 433, 641, 808
  - with power-law nonlinearity in derivatives, 146, 161, 167
  - with quadratic nonlinearities, 805, 896
  - with three independent variables, 35, 838
  - with three or more space variables, 406
  - with three or more space variables, involving arbitrary functions, 624
  - with three space variables, involving arbitrary parameters, 604
  - with three space variables, involving exponential nonlinearities, 722
  - with three space variables, involving power-law nonlinearities, 713
  - with three variables, involving arbitrary functions, 139
  - with three variables, quadratic in derivatives, 125
  - with trigonometric nonlinearities, 276, 389, 680
  - with two independent variables, 1355
  - with two independent variables, involving arbitrary functions, 19
  - with two independent variables, involving arbitrary parameters, 3
  - with two independent variables, nonlinear in two or more highest derivatives, 849
  - with two space variables, involving arbitrary functions, 589
  - with two space variables, involving exponential nonlinearities, 384, 574
  - with two space variables, involving power-law nonlinearities, 367, 553
  - nonlinear first-order partial differential equation, 1373
  - nonlinear functional equations containing complex argument, 1776
  - nonlinear functional equations reducible to bilinear equations, 1775
  - nonlinear Klein–Gordon equation, 499, 1494
  - nonlinear Kolmogorov type equation, 377, 398
  - nonlinear parabolic equations, 1677, 1725
  - nonlinear partial differential equations, 1650, 1709
    - with Maple, 1625
    - with Mathematica, 1687
    - with MATLAB, 1735
  - nonlinear Poisson–Boltzmann equation, 1755
  - nonlinear Poisson equation, 1679, 1727, 1750
  - nonlinear problems of suspension transport in porous media, 1604
  - nonlinear Schrödinger equation, 348, 425, 1582
  - nonlinear Schrödinger equations and related equations, 348
  - nonlinear systems
    - of first-order PDEs, 1659, 1719, 1720
    - of many equations involving first derivatives with respect to  $t$ , 1348
    - of partial differential equations, 1599
    - of second-order PDEs, 1660, 1661, 1720, 1721
    - of two equations involving first derivatives with respect to  $t$ , 1337
    - of two equations involving second derivatives with respect to  $t$ , 1344
  - nonlinear telegraph equations with two space variables, 583
  - nonlinear wave equation, 1400, 1519, 1536, 1673, 1678, 1723, 1727, 1764
  - nonlocal transformation, 1412
  - nonstationary equations, 942
    - of motion of viscous incompressible fluid, 1013

nonstationary hydrodynamic equations  
(Navier–Stokes equations), 1013  
notation, 1630, 1692  
 $n$ th-order chemical reaction, 1142  
 $n$ th-order Liouville type equation, 1109  
number  
Grashov, 1329  
Mach, 757, 1203  
Prandtl, 347, 1329  
Reynolds, 253, 1013, 1021, 1260, 1275,  
1291, 1310–1312  
Reynolds, modified, 1280  
numerical and graphical solutions, 1673,  
1723  
by default methods, 1672  
specifying single-stage numerical method,  
1674  
specifying single-stage numerical method  
and numerical boundary condition  
(NBC), 1676  
specifying two-stage numerical method,  
startup method, and NBC, 1676  
numerical approximations, 1627, 1689  
numerical methods embedded in Maple,  
1674  
numerical solutions and their visualizations,  
1672, 1722  
numerical solutions via predefined functions,  
1741

## O

Olver–Rosenau solution, 1028  
one-dimensional barotropic flows of ideal  
compressible gas, 1127  
one-dimensional case, 1205  
one-dimensional polytropic ideal gas  
flow, 1125  
one-dimensional rotation fluid flows, 1257  
one-disk problem, 1290  
one-mode solution, 1683, 1731  
one-parameter Lie groups of point transfor-  
mations, 1526  
one-parameter transformations, 1513  
local properties, 1513  
one-soliton solution, 869, 1592, 1638, 1698  
of mKdV equation, 867  
of potential KdV equation, 876  
online help system, 1626, 1737  
operator  
infinitesimal, 1513, 1514, 1526  
infinitesimal, invariant, 1514  
invariant, 1514, 1526  
second prolongation, 1516  
operators  
arithmetic, 1627, 1738  
assignment/unassignment, 1627  
basic arithmetic, 1689  
commutator, 1579  
logical, 1628, 1689, 1738  
range, 1627  
relational, 1627, 1738, 1739

operators := and =, 1627  
order reduction of hydrodynamic type  
equations, 1422  
order reduction procedure for equations with  
 $n \geq 2$  (reduction to solvable form with  
 $n = 1$ ), 1446  
ordinary differential equation  
Airy, 861  
Emden–Fowler, 248, 442, 444, 447, 462,  
464, 647, 648, 655  
Emden–Fowler, generalized, 327, 477, 511,  
512, 513, 516, 527, 528, 697, 698  
hypergeometric, 1012  
Painlevé, first, 861, 989  
Painlevé, second, 861, 867, 988, 989  
Riccati, 140, 142, 162, 164, 423, 425, 453,  
482, 520, 1012, 1277  
Yermakov, 309, 518  
ordinary differential equations, 1445  
oscillatory motion  
of flat plate, 1252  
of flat porous plate, 1265  
Ostrovsky equation, 968  
overdetermined systems  
of first-order equations in one unknown,  
1599  
of two equations, 1599

## P

packages (subpackages), 1627  
Painlevé equations, 1566  
Painlevé property, 1566  
Painlevé test, 1569  
for nonlinear equations of mathematical  
physics, 1565  
for ordinary differential equations, 1566  
for systems of ordinary differential  
equations, 1569  
palettes, 1627, 1688, 1691, 1737  
palindromic equation, 1442  
palindromic polynomial, 1442  
partial differential equation  
adiabatic, 1262  
BBM, 958  
Bernoulli, 394, 421  
Born–Infeld, 766, 1401  
boundary layer, for non-Newtonian  
fluid, 917  
boundary layer, for power-law fluid with  
pressure gradient, 913  
Boussinesq, 368, 987, 1504  
Boussinesq, in canonical form, 987  
Boussinesq-type, 1028  
Burgers, 186, 1409, 1414, 1572, 1637,  
1673, 1677, 1697, 1723, 1725, 1743,  
1761  
Burgers–Huxley, 189  
Burgers–Korteweg–de Vries, 884  
Calogero, 745, 746  
Calogero-type, 1400



- partial differential equation (*continued*)  
 Camassa–Holm, 968  
 Chaplygin, 765  
 Clairaut, 118, 152, 172, 1375  
 Clairaut, in implicit form, 122  
 combined KdV–mKdV, 871  
 complete Lin–Reissner–Tsien, 757  
 continuity, 1197, 1247, 1610  
 cylindrical Burgers, 191  
 cylindrical Korteweg–de Vries, 866  
 Degasperis–Procesi, 968  
 determining, 1555  
 double sine-Gordon, 492  
 double sinh-Gordon, 485  
 Dym, 878  
 elliptic, 1392  
 Enneper, 491  
 Euler–Lagrange, 1595  
 evolution, nonlinear in second derivative, 346  
 fast diffusion, 211  
 first-order quasilinear, 1355  
 Fisher, 176, 1639, 1699, 1744  
 FitzHugh–Nagumo, 179, 1746  
 fKdV, 1034  
 Fokas–Yortsos, 237  
 fourth-order, Liouville type, 1030  
 fourth Painlevé, 988  
 Fujita–Storm, 212  
 Gardner, 871  
 Gauss, 1772  
 general fifth-order KdV, 1034  
 generalized Burgers, 288  
 generalized Burgers–Korteweg–de Vries, 1045, 1503  
 generalized Calogero, 748  
 generalized Kadomtsev–Petviashvili, 1029  
 generalized Khokhlov–Zabolotskaya, 751  
 generalized Korteweg–de Vries, 871  
 generalized Kuramoto–Sivashinsky, 983  
 generalized Landau–Ginzburg, 360  
 generalized Liouville, 1108  
 Gibbons–Tsarev, 764  
 Goursat, 549  
 Grad–Shafranov, 678, 691  
 Hamilton–Jacobi, 1379  
 Hamilton–Jacobi, Cauchy problem, 1380  
 Harry Dym, 878  
 Helmholtz, 380, 397, 399, 420, 423, 558, 570, 601, 938, 1289  
 homogeneous Monge–Ampère, 775, 1430  
 Hopf, 5  
 Hunter–Saxton, 745  
 hydrodynamic boundary layer, with pressure gradient, 907  
 hyperbolic, first canonical form, 1391  
 hyperbolic, second canonical form, 1392  
 inviscid Burgers, 1674, 1763  
 inviscid Burgers (explicit method), 1678, 1725  
 inviscid Burgers (initial value problem), 1762  
 inviscid Burgers (shock waves and rarefaction waves), 1757  
 inviscid Burgers (shock waves and weak solutions), 1759  
 Ito, 1037  
 $k(n, n)$ , 891  
 Kadomtsev–Petviashvili, 1000, 1587  
 Kadomtsev–Petviashvili, in canonical form, 1000  
 Kadomtsev–Petviashvili type, 1002  
 Kármán–Howarth, 253  
 Kaup–Kupershmidt, 1036  
 Kawahara, 1032  
 KdV, 857  
 Khokhlov–Zabolotskaya, 749  
 KK, 1036  
 Klein–Gordon, 1641, 1656, 1701, 1716  
 Kolmogorov–Petrovskii–Piskunov (KPP), 279, 1633, 1694  
 Korteweg–de Vries, 857, 1574, 1580, 1583, 1638, 1698  
 Korteweg–de Vries, in canonical form, 857  
 Korteweg–de Vries–Burgers, 884  
 Korteweg–de Vries type, with exponential nonlinearity, 874  
 Korteweg–de Vries type, with logarithmic nonlinearity, 874  
 Korteweg–de Vries type, with power-law nonlinearity, 872  
 KPP-type, 1633, 1694  
 Kuramoto–Sivashinsky, 982  
 Laplace, 394, 409, 421, 556, 558, 579, 646, 938, 1392  
 Lax, 1035, 1068  
 Lax, with forcing term, 1037  
 Lin–Reissner–Tsien, 756, 759  
 linear heat, 807, 1252  
 linear Schrödinger, 865, 1186  
 linear wave, 1392  
 Liouville, 144, 165, 470, 540, 1117, 1414  
 mKdV, 867  
 model, for dynamics of nonlinear strings, 534  
 model, of gas dynamics, 5, 25, 1360  
 model, of nonlinear waves with damping, 6  
 modification of coupled KdV, 1172  
 modified Burgers–Korteweg–de Vries, 886  
 modified Burgers, 191  
 modified Harry Dym, 891  
 modified  $k(n, n)$ , 892  
 modified Korteweg–de Vries, 862, 866, 869, 1583  
 modified Korteweg–de Vries–Burgers, 886  
 modified Korteweg–de Vries, in canonical form, 867  
 Monge–Ampère, 774, 1393  
 $n$ -dimensional modified Schrödinger, with cubic nonlinearity, 431  
 $n$ -dimensional Schrödinger, with cubic nonlinearity, 430

- partial differential equation (*continued*)
- Newell–Whitehead, 1534
  - ninth-order KdV-type, 1041
  - nonlinear diffusion, 1645, 1705
  - nonlinear diffusion, with cubic source, 1577
  - nonlinear first-order, 1373
  - nonlinear Klein–Gordon, 499, 1494
  - nonlinear Kolmogorov type, 377, 398
  - nonlinear Poisson, 1679, 1727, 1750
  - nonlinear Poisson–Boltzmann, 1755
  - nonlinear Schrödinger, 348, 425, 1582
  - nonlinear wave, 1400, 1519, 1536, 1673, 1678, 1723, 1727, 1764
  - $n$ th-order Liouville type, 1109
  - of axisymmetric steady hydrodynamic boundary layer, 1508
  - of Burgers hierarchy, 1067
  - of complete Korteweg–de Vries hierarchy, 1069
  - of helical surface, 8
  - of Korteweg–de Vries hierarchy, 1068
  - of light rays, 63
  - of minimal surfaces, 768, 1597
  - of modified Korteweg–de Vries hierarchy, 1069
  - of steady transonic gas flow, 657
  - of surface of bodies of revolution, 8
  - of unsteady transonic gas flows, 756
  - Ostrovsky, 968
  - Plebański first heavenly, 802
  - Plebański second heavenly, 803
  - Poisson, 379, 397, 423, 580, 588, 938, 1008
  - porous medium, 210
  - potential, of one-dimensional flow of compressible gas, 768
  - potential Korteweg–de Vries (KdV), 876
  - potential modified Korteweg–de Vries (mKdV), 877
  - Rayleigh–Zababakhin–Plesset, 1262
  - Sawada–Kotera, 1035
  - Sawada–Kotera, with forcing term, 1038
  - Schrödinger, of general form, 358, 360, 363, 364
  - Schrödinger, with cubic nonlinearity, 348, 350, 351, 352, 355
  - Schrödinger, with power-law nonlinearity, 351, 353
  - Schwarzian Korteweg–de Vries, 870
  - second-order nonlinear, 1392
  - second-order quasilinear, 1393
  - seventh-order KdV-type, 1040
  - Sharm–Tasso–Olver, 887, 1067
  - sine-Gordon, 485, 490, 543, 1117, 1635, 1639, 1646, 1695, 1698, 1706
  - sinh-Gordon, 485, 542, 1580
  - SK, 1035
  - spherical Korteweg–de Vries, 866
  - stationary heat, with nonlinear source, 682
  - stationary Khokhlov–Zabolotskaya, 649
  - telegraph, 494, 538, 583, 585
  - thin film, 985
  - third-order Liouville type, 972
  - Thomas, 544
  - three-dimensional Khokhlov–Zabolotskaya, 752
  - three-dimensional nonlinear Schrödinger, of general form, 429
  - three-dimensional Schrödinger, with cubic nonlinearity, 428
  - Tricomi, 659
  - two-dimensional Khokhlov–Zabolotskaya, 749
  - two-dimensional linear heat, 1256
  - two-dimensional nonlinear Schrödinger, of general form, 427
  - two-dimensional Schrödinger, with cubic nonlinearity, 425
  - two-dimensional Schrödinger, with power-law nonlinearity, 427
  - Tzitzéica, 541
  - unnormalized Boussinesq, 990
  - unnormalized Burgers, 187
  - unnormalized Kadomtsev–Petviashvili, 1002
  - unnormalized Korteweg–de Vries, 865
  - unnormalized modified Korteweg–de Vries, 870
  - variant of modified Burgers–Korteweg–de Vries, 886
  - vector Burgers, 417
  - Weber, 1193
- partial differential equations
- admitting variational form, 1595
  - axisymmetric steady laminar hydrodynamic boundary layer, 909
  - axisymmetric unsteady laminar boundary layer, 929
  - Bellman type, 805
  - Benney moment, 764
  - boundary layer (Prandtl equations), 1333
  - elliptic, canonical form, 1392
  - evolution, canonic Bäcklund transformations, 1420
  - Chaplygin, 1202
  - Charpit, 1647, 1706
  - chromatography, 1231
  - cubic in derivatives, 134
  - Euler, 938, 1197, 1681, 1729
  - Euler, for barotropic gas flow, 1201
  - Euler, in Gromeka–Lamb form, 1201
  - Euler, in various coordinate systems, 1197
  - evolution, nonlinear in second derivative, 346
  - exact methods, 1353
  - explicitly dependent on  $x$  and/or  $t$ , 266
  - fifth-order, 1031
  - first-order with three or more independent variables, 125
  - first-order with two independent variables
  - quadratic in derivatives, 43

- partial differential equations (*continued*)
- first-order with two independent variables
    - of general form, 99
  - first-order quasilinear, 3
  - for convective fluid motions, 1329
  - fourth-order, 977
  - Gelfand–Levitan–Marchenko type, 1584
  - heat, with power-law or exponential temperature-dependent thermal diffusivity, 409
  - heat and mass transfer, 697
  - heat and mass transfer, in quiescent or moving media with chemical reactions, 390
  - heat and mass transfer, with complicating factors, 734
  - hydrodynamic boundary layer, 903
  - hydrodynamic type, order reduction, 1422
  - hyperbolic, canonical form, 1390
  - invariance under scaling transformations, 1431
  - invariance under translations, 1429
  - involving arbitrary differential operators, 1101
  - involving arbitrary functions, 77, 279, 390, 499, 546, 682
  - involving arbitrary functions of derivatives, 113
  - involving arbitrary functions of four variables, 123
  - involving arbitrary functions of independent variables, 107
  - involving arbitrary functions of one variable, 19, 113
  - involving arbitrary functions of three variables, 120
  - involving arbitrary functions of two variables, 30, 116, 168
  - involving arbitrary parameters, 43, 540
  - involving arbitrary powers of derivatives, 102, 136
  - involving cosine, 276
  - involving cotangent, 278
  - involving derivatives in radicands, 101
  - involving exponential nonlinearities, 587
  - involving first derivative in  $t$ , 811, 857, 977
  - involving first derivative in  $t$  and linear in highest derivative, 1031
  - involving fourth powers of derivatives, 99
  - involving hyperbolic cosine, 268
  - involving hyperbolic cotangent, 270
  - involving hyperbolic sine, 269
  - involving hyperbolic tangent, 270
  - involving inverse trigonometric functions, 279
  - involving mixed derivatives, 1000, 1103
  - involving one arbitrary power of derivative, 107
  - involving power-law functions of derivatives, 156
  - involving power-law nonlinearities, 583
  - involving products of derivatives, 133
  - involving products of derivatives with respect to different variables, 131
  - involving roots and moduli of derivatives, 136
  - involving second derivative in  $t$ , 896, 987, 1088
  - involving second-order mixed derivatives, 949
  - involving sine, 277
  - involving squares of derivatives, 133
  - involving squares of one or two derivatives, 125
  - involving squares of three derivatives, 130
  - involving tangent, 278
  - involving third-order mixed derivatives, 958
  - involving two or more second derivatives, 839
  - involving two or three arbitrary powers of derivatives, 111
  - linear in mixed derivative, 745, 847
  - Navier–Stokes, 1247
  - Navier–Stokes, general properties, 1249
  - Navier–Stokes, in Boussinesq approximation, 1329
  - Navier–Stokes, in various coordinate systems, 1247
  - nonlinear, diffusion boundary layer, 402
  - nonlinear, elliptic, geometrical models, 1754
  - nonlinear, elliptic, in two space dimensions, 1748
  - nonlinear, in highest derivatives, 404
  - nonlinear, in two independent variables, 1392
  - nonlinear, involving arbitrary linear differential operators, 1065
  - nonlinear, involving arbitrary parameters, 99
  - nonlinear, of general form, 150, 169, 1392
  - nonlinear, of thermal (diffusion) boundary layer, 346
  - nonlinear, parabolic, 1677, 1725
  - nonlinear, second-order, 1516
  - nonlinear, simple separation of variables, 1459
  - nonlinear, telegraph, with two space variables, 583
  - nonlinear, with arbitrary number of variables involving arbitrary functions, 162
  - nonlinear, with arbitrary number of variables involving arbitrary parameters, 158
  - nonlinear, with four independent variables, 154
  - nonlinear, with three variables involving arbitrary functions, 139

- partial differential equations (*continued*)
- nonlinear, with three variables quadratic in derivatives, 125
  - nonstationary, 942
  - nonstationary, hydrodynamic (Navier–Stokes equations), 1013
  - nonstationary, of motion of viscous incompressible fluid, 1013
  - of atmospheric circulation in equatorial region, 1225
  - of breeze and monsoons, 1223
  - of Burgers and Korteweg–de Vries hierarchies, 1067
  - of dynamic convection in the sea, 1227
  - of flows in the baroclinic layer of the ocean, 1229
  - of general form, involving arbitrary functions of single argument, 358
  - of general form, involving arbitrary functions of two arguments, 362
  - of general form, involving first derivative in  $t$ , 1070
  - of heat and mass transfer in anisotropic media, 412
  - of higher orders, 1031
  - of ideal incompressible fluid, 942
  - of ideal plasticity, 1238
  - of mass transfer in quiescent or moving media with chemical reactions, 406
  - of motion of ideal fluid (Euler equations), 938, 1197
  - of nonlinear vibrations stratified medium, 1131
  - of sixth- to ninth-order, 1039
  - of stationary transonic plane-parallel gas flow, 1122
  - of viscous incompressible fluid, 1003
  - Plebański heavenly, 802
  - parabolic, canonical form, 1390
  - passing Painlevé test, 1572
  - quadratic in derivatives, 139, 154, 158, 162
  - quadratic in highest derivatives, 772
  - quasilinear, 1393, 1647, 1649, 1707, 1708
  - quasilinear, discontinuous solutions, 1360
  - quasilinear, in conservative form, 1368
  - quasilinear, of general form, 1368
  - quasilinear, qualitative features, 1360
  - quasilinear, with  $n$  independent variables, 1356
  - reducible to Korteweg–de Vries equation, 875
  - second-order, classification, 1389
  - second-order, elliptic, with three or more space variables, 713
  - second-order, elliptic, with two space variables, 641
  - second-order, evolution, 1547
  - second-order, hyperbolic, 1551
  - second-order, hyperbolic, with one space variable, 433
  - second-order, hyperbolic, with two or more space variables, 553
  - second-order, involving mixed derivatives and some other, 745
  - second-order, involving real functions of real variables, 1165
  - second-order, nonlinear, for laser systems, 1170
  - second-order, of general form, 811, 1553
  - second-order, parabolic, with one space variable, 175
  - second-order, parabolic, with two or more space variables, 367
  - semilinear, in two independent variables, 1389
  - shallow water, 1124
  - stationary, 938
  - stationary, hydrodynamic (Navier–Stokes equations), 1003
  - steady boundary layer, for non-Newtonian fluids, 911
  - steady hydrodynamic boundary layer, for Newtonian fluid, 903
  - steady hydrodynamic boundary layer, symmetries, 1528
  - steady-state hydrodynamic boundary layer, 903
  - third-order, 857
  - three- and  $n$ -dimensional, 428
  - three-argument functional, 1497
  - three-dimensional, 1240
  - three-dimensional, involving arbitrary functions, 730
  - three-dimensional, of ideal plasticity, 1240
  - transformations, 1395
  - two-dimensional, 425, 1238
  - two-dimensional Euler, for incompressible ideal fluid (plane flows), 1198
  - with arbitrary dependence on derivatives, 148
  - with arbitrary number of independent variables, 39
  - with coefficients involving exponential functions, 11
  - with coefficients involving hyperbolic functions, 14
  - with coefficients involving logarithmic functions, 16
  - with coefficients involving power-law functions, 3
  - with coefficients involving trigonometric functions, 17
  - with cubic nonlinearities involving arbitrary functions, 355
  - with exponential nonlinearities, 254, 469, 662
  - with hyperbolic nonlinearities, 268, 485, 675
  - with logarithmic nonlinearities, 271, 388, 486, 677
  - with  $n$  independent variables, 739, 853
  - with  $n$  space variables, 417

- partial differential equations (*continued*)  
 with power-law nonlinearities, 175, 433, 641, 808  
 with power-law nonlinearity in derivatives, 161, 167  
 with power nonlinearity in derivatives, 146  
 with quadratic nonlinearities, 805, 896  
 with three independent variables, 35, 838  
 with three or more space variables, 406  
 with three or more space variables, involving arbitrary functions, 624  
 with three space variables, involving arbitrary parameters, 604  
 with three space variables, involving exponential nonlinearities, 722  
 with three space variables, involving power-law nonlinearities, 713  
 with trigonometric nonlinearities, 276, 389, 680  
 with two independent variables, 1355  
 with two independent variables, involving arbitrary functions, 19  
 with two independent variables, involving arbitrary parameters, 3  
 with two independent variables, nonlinear in two or more highest derivatives, 849  
 with two space variables involving arbitrary functions, 589  
 with two space variables involving exponential nonlinearities, 384, 574  
 with two space variables involving power-law nonlinearities, 367, 553  
 unsteady boundary layer, for Newtonian fluid, 917  
 unsteady boundary layer, for non-Newtonian fluids, 930  
 von Kármán (fourth-order elliptic equations), 1192
- pattern, 1689, 1739
- performing Painlevé test and truncated expansions for studying some nonlinear equations, 1572
- persistent variables, 1739
- Pexider equation, 1771
- Pfaffian equations, 1600  
 not satisfying the integrability condition, 1602  
 their solutions, 1600
- phase diagram, 1640, 1700
- phase portraits, 1639, 1699
- phase trajectories, 1640, 1700
- plane jet, 1335
- plane radially symmetric unsteady fluid motion, 1261
- Plebański heavenly equation  
 first, 802  
 second, 803
- Poincaré phase plane, 1640, 1700
- point transformations: overview and examples, 1395
- Poisson equation, 379, 397, 423, 580, 588, 938, 1008
- polar coordinates, 1198, 1248
- porous medium equation, 210
- potential, 1587
- potential equation of one-dimensional flow of compressible gas, 768
- potential flow, 1334
- potential gas flow, 1201
- potential Korteweg–de Vries (KdV) equation, 876
- potential modified Korteweg–de Vries (mKdV) equation, 877
- power-law non-Newtonian fluid, 911
- power isotherm, 1234
- Prandtl–Meyer solutions, 1203
- Prandtl solution, 1238
- predefined constants, 1628, 1740
- predefined functions, 1628, 1740
- pressure flow in rotating layer, 1283
- pressure gradient, 1253
- previous results, 1626, 1688, 1737
- probability integral, 187
- problem  
 Blasius, 904, 1333  
 Blasius, reversed statement, 1334  
 boundary value, 1679, 1727  
 Cauchy, 1357, 1379, 1611  
 Cauchy, classical, 1647, 1707, 1709, 1756  
 Cauchy, for Hamilton–Jacobi equation, 1380  
 Cauchy, procedure of solving, 1358  
 Cauchy, qualitative features of solutions, 1611  
 Cauchy, solution, 1360  
 Cauchy, solution by inverse scattering problem method, 1587  
 Cauchy, solution for nonlinear equations by inverse scattering problem method, 1589  
 direct scattering, 1587  
 Falkner–Skan, 907, 1334  
 first Stokes, 1251  
 generalized Blasius, 912  
 generalized Cauchy, 1649, 1650, 1708, 1709  
 generalized Falkner–Skan, 914  
 generalized Schlichting, 912  
 Hiemenz, 1264  
 initial value, 1383, 1611  
 initial value, for inviscid Burgers equation, 1762  
 inverse problem, 1455  
 inverse scattering, 1587  
 inverse scattering, methods of solving, soliton theory, 1579  
 Jeffery–Hammel, 1261  
 jet-source, 1335  
 Landau, 1012  
 one-disk, 1290  
 of motion of material point, 126  
 of motion of rod, 129  
 of propagation of signal, 1367

- problem (*continued*)  
 of suspension transport in porous media, 1604  
 on motion of two point bodies, 126  
 without initial data, 1252, 1256  
 Riemann, 1611  
 Riemann, qualitative features of solutions, 1611  
 Schlichting, 905  
 second Stokes, 1252  
 terminal value, 1383, 1386  
 two-body, in celestial mechanics, 65  
 two-disk, 1291
- problems  
 boundary layer, self-similar solutions, 1333  
 Cauchy, solutions, 1756  
 Riemann, solutions, 1618  
 simple inverse, determination of form of equations from their properties, 1455
- procedure  
 for constructing exact solutions, 1450  
 for constructing invariant solutions, 1520  
 of solving Cauchy problem, 1358
- prolongation of group generator, 1527
- prompt symbol, 1626, 1736
- pseudo-differential equations, 1484, 1483
- pure functions, 1690
- purely radial fluid motions, 1260
- Q**
- qualitative features and discontinuous solutions of quasilinear equations, 1360
- quasi-plane flow, 1285
- quasi-plane flows (with fluid velocity components independent of  $z$ ), 1285
- quasilinear equations, 35, 1393, 1647, 1649, 1707, 1708  
 discontinuous solutions, 1360  
 first-order, 3, 1355  
 first-order, hyperbolic systems, 1607  
 first-order, methods for solving, 1355  
 hyperbolic systems, 1607  
 in conservative form, 1368  
 of general form, 1368  
 PDEs, 1647, 1649, 1707, 1708  
 qualitative features, 1360  
 second-order, 1393  
 semi-Hamiltonian system, 1236  
 with  $n$  independent variables, 1356
- quotes, 1740
- R**
- range operator, 1627
- Rankine–Hugoniot condition, 1126, 1128, 1759
- Rankine–Hugoniot jump condition, 1363, 1369, 1615
- rarefaction wave, 6, 26, 1360, 1360, 1611, 1758
- rational solution, 858
- Rayleigh–Zababakhin–Plesset equation, 1262
- reciprocal equation, 1442
- reciprocal polynomial, 1442
- reduction of systems to canonical form, 1611
- reduction to standard functional equation, 1496
- redundant solution, 1662
- reflectance, 1588
- reflection factor, 1588
- regular expression, 1739
- regular point of generalized solution, 1383
- related equations, 935
- relational operators, 1627, 1738, 1739
- remarks on Painlevé test, 1567
- removing redundant exact solutions, 1665
- removing redundant solutions via predefined functions, 1667
- resonance, Painlevé test, 1570
- reversed statement of Blasius problem, 1334
- Reynolds number, 1021, 1260
- RF pairs, 1413  
 their use for constructing Bäcklund transformations, 1415
- Riccati equation, 140, 142, 162, 164, 423, 425, 453, 482, 520, 1012, 1277
- Riemann invariants, 1231, 1237, 1609, 1611, 1612
- Riemann problem, 1611  
 qualitative features of solutions, 1611
- Riemann simple waves, 1125, 1127, 1129
- rotation transformation, 1396
- rotationally symmetric motions of fluid, 1200
- rotationally symmetric motions of general form, 1297
- round jet, 1277
- Ryzhov–Shefter solution, 759
- S**
- Sawada–Kotera equation, 1035  
 with forcing term, 1038
- scalar nonlinear PDEs in one space dimension, 1742
- scaling transformation, 1396, 1645, 1705, 1770
- scattering data, 1588
- scheme for constructing exact solutions by nonclassical method, 1533
- Schlichting–Bickley problem, 1335
- Schlichting problem, 905
- Schrödinger equation  
 of general form, 358, 360, 363, 364  
 with cubic nonlinearity, 348, 350, 351, 352, 355  
 with power-law nonlinearity, 351, 353
- Schwarzian Korteweg–de Vries equation, 870
- script, 1737, 1741  
 m-files, 1737

- second hodograph transformation, 1400
- second-order differential constraints, 1553  
for PDEs, 1553
- second-order elliptic equations  
with three or more space variables, 713  
with two space variables, 641
- second-order equations  
Bäcklund transformations, 1413  
classification, 1389  
elliptic, 1191  
elliptic, with three or more space variables, 713  
elliptic, with two space variables, 641  
evolution, 1547  
hyperbolic, 1551  
hyperbolic, with one space variable, 433  
hyperbolic, with two or more space variables, 553  
involving second-order mixed derivatives, 949  
involving mixed derivatives and some other, 745  
involving real functions of real variables, 1165  
Klein–Gordon type, 1173  
nonlinear, 1516  
nonlinear, classification, 1389, 1565  
nonlinear, for laser systems, 1170  
nonlinear partial differential, 1392  
nonlinear, symmetries, 1516  
of general form, 811, 1553  
of reaction-diffusion type, 1620  
parabolic, with one space variable, 175  
parabolic, with two or more space variables, 367  
quasilinear, 1393
- second-order evolution equations, 1547
- second-order hyperbolic equations, 1551  
with one space variable, 433  
with two or more space variables, 553
- second-order nonlinear equations of laser systems, 1170
- second-order parabolic equations  
with one space variable, 175  
with two or more space variables, 367
- second-order quasilinear partial differential equation, 1393
- second Painlevé equation, 861, 867, 988, 989
- second prolongation of operator, 1516
- second Stokes problem, 1252
- self-similar continuous solutions, 1607
- self-similar solutions, 1429, 1431, 1452  
of some boundary layer problems, 1333
- self-similar variables, 1645, 1705
- semi-Hamiltonian system of quasilinear equations, 1236
- semilinear equations in two independent variables, 1389
- separation constant, 1459
- separation of variables, 1651, 1710
- sequences, 1629
- set formula, 1755
- sets, 1629, 1691
- seventh-order KdV-type equation, 1040
- shallow water equations, 1124
- Sharm–Tasso–Olver equation, 887, 1067
- Shcheprov solution, 1278
- shock wave, 6, 26, 1675, 1126, 1128, 1362, 1615, 1616, 1758
- similarity and invariant solutions, 1646
- similarity method, 1431
- similarity reductions in equations with three or more independent variables, 1510
- similarity transformation, 1645, 1705
- simple inverse problems (determination of form of equations from their properties), 1455
- simple nonlinear point transformations, 1396
- simple Riemann waves, 1609
- simple scheme for studying nonlinear partial differential equations, 1570
- simple separation of variables in nonlinear partial differential equations, 1459
- simple transformations, 1446
- simplest model of chemical reactor with second-order kinetic functions, 1115
- simplest plane purely radial fluid motion, 1260
- simplified scheme for constructing generalized separable solutions, 1465
- simplifying exact solutions, 1665
- Simulink, 1736
- sine-cosine method, 1642, 1702
- sine-Gordon equation, 490, 543, 1117, 1635, 1639, 1646, 1695, 1698, 1706
- single-precision floating point, 1740
- single-soliton solution, 491
- singular integral, 1373, 1374
- singular point, 1640, 1700  
of generalized solution, 1383
- sinh-Gordon equation, 485, 542, 1580
- SK equation, 1035
- Slezkin solution, 1276
- slow diffusion, 251
- soliton, 857, 1636, 1695
- solution  
additive separable, 1374, 1459  
by reduction to equations with quadratic (or power) nonlinearities, 1487  
complete, 1647, 1706  
Couette–Poiseuille type, 1283  
general, first-order PDEs, 1355  
generalized, 1364  
generalized, regular points, 1383  
generalized, singular points, 1383  
generalized, stability condition, 1369  
invariant, 1431, 1435, 1451, 1513, 1520, 1527, 1602, 1620  
Jeffery–Hamel, 1272  
Landau, 1277  
limiting self-similar, 1454, 1456  
methods, 1373

- solution (*continued*)
- Mises, 768
  - multiplicative separable, 1374, 1459, 1651, 1710
  - $n$ -soliton, 859, 1591
  - $n$ -soliton, of Korteweg–de Vries equation, 1591
  - Nadai, 1238
  - Nadai, multiplicative separable, 1238
  - nonclassical self-similar, 500, 685, 689, 1435
  - nonclassical traveling-wave, 679, 690, 706
  - noninvariant self-similar, 1435
  - of Cauchy problem, 1360
  - of Cauchy problem by inverse scattering problem method, 1587
  - of Cauchy problem for nonlinear equations by inverse scattering problem method, 1589
  - of determining equations in form of polynomials in  $\lambda$ , 1582
  - of functional-differential equations by differentiation, 1467
  - of functional-differential equations by splitting, 1471
  - Olver–Rosenau, 1028
  - one-mode, 1683, 1731
  - one-soliton, 869, 1592, 1638, 1698
  - one-soliton, mKdV equation, 867
  - one-soliton, potential KdV equation, 876
  - Prandtl, 1238
  - rational, 858
  - redundant, 1662
  - Ryzhov–Shefter, 759
  - self-similar, 1429, 1431, 1452
  - Shcheprov, 1278
  - single-soliton, 491
  - Slezkin, 1276
  - three-soliton, KdV equation, 859
  - traveling-wave, 1429, 1602, 1615, 1620, 1637, 1659, 1697, 1720
  - two-soliton, 491, 869
  - two-soliton, KdV equation, 858
  - two-soliton, periodic, 492
  - viscosity, 1365, 1366
  - Volosov, 179
  - von Mises, 768
  - weak, 1364, 1675, 1758
- solutions
- additive separable, 1459
  - along characteristics, constructing method, 1647, 1706
  - analytical, 1629, 1691
  - analytical, nonlinear systems, 1659, 1719
  - analytical-numerical, 1680, 1728
  - classical self-similar, 1435
  - classical traveling-wave, 1431
  - describing shock waves, 1618
  - discontinuous, quasilinear equations, 1360
  - exact, using nonclassical method, 1533
  - exact, using symmetries of equations, 1520
  - exact, verifying, 1667
  - for fixed singularities, 1565
  - for Pfaffian equations, 1600
  - for Riemann problem, 1618
  - functional separable, structure, 1487
  - generalized separable, structure, 1464
  - generalized separable, simplified scheme for constructing, 1465
  - generalized traveling-wave, 1487
  - generalized viscosity, 1382
  - generalized viscosity, local structure, 1383
  - generalizing exact, 1665
  - invariant, 1646
  - multipeakon, 968
  - multiplicative separable, 1459
  - numerical, their visualizations, 1672, 1722
  - numerical, via predefined functions, 1741
  - numerical and graphical, 1673, 1723
  - numerical and graphical, by default methods, 1672
  - numerical and graphical, specifying single-stage numerical method, 1674
  - numerical and graphical, specifying single-stage numerical method and numerical boundary condition (NBC), 1676
  - numerical and graphical, specifying two-stage numerical method, startup method, and NBC, 1676
  - of nonlinear equations that fail Painlevé test, using truncated expansions, 1577
  - of nonlinear functional equations and their applications, 1496
  - of partial differential equations with movable pole, 1569
  - of simple functional equations and their application, 1472
  - one-parameter, using symmetries of equations, 1520
  - removing redundant, exact, 1665
  - removing redundant, via predefined functions, 1667
  - self-similar continuous, 1607
  - self-similar, for some boundary layer problems, 1333
  - similarity, 1646
  - simplifying exact, 1665
  - special functional separable, 1487
  - stable generalized, method for constructing, 1370
  - steady-state, 1329
  - symbolic and numerical, with Maple, Mathematica and MATLAB, 1623
  - traveling-wave, constructing method, 1637, 1659, 1697, 1719
  - two-dimensional, in cylindrical coordinates (plane flows), 1270
  - two-dimensional, in rectangular Cartesian coordinates (plane flows), 1263
  - unsteady, 1331
  - via predefined functions, method for constructing, 1692



- solutions (*continued*)
- via transformations, constructing method, 1635, 1694
  - viscosity, based on test functions and differential inequalities, 1383
  - viscosity, based on use of parabolic equation, 1382
  - with linear dependence of velocity components on one space variable, 1323
  - with linear dependence of velocity components on two space variables, 1303, 1317
  - with movable singularities, 1565
  - with movable singularities, for ordinary differential equations, 1565
  - with one nonzero component of fluid velocity, 1251
  - with spiral symmetry, 1328
  - with three nonzero fluid velocity components dependent on three space variables, 1302
  - with three nonzero fluid velocity components dependent on two space variables, 1285
  - with two nonzero components of fluid velocity, 1263
- solving Cauchy problems, 1756
- solving nonlinear ODEs, 1664
- some systems depending on arbitrary parameters, 1150
- spatial discretization, 1743
- special form for symmetry reduction, 1505
- special functional separable and generalized traveling-wave solutions, 1487
- special functional separable solutions, 1487
- special functions, 1740
- spectral collocation method, 1680, 1729
- spherical Korteweg–de Vries equation, 866
- spherical radially symmetric fluid motion, 1261
- spherical radially symmetric unsteady fluid motion, 1262
- spherical vortex, 1278
- splitting in derivatives, 1516
- splitting method, 1496
- splitting procedure, 1527
- stability condition, 1369
- for generalized solution, 1369
- statement separator, 1628, 1739
- statements, 1628, 1739
- stationary anisotropic heat (diffusion) equation, 702
- stationary equations, 938
- stationary heat equation with nonlinear source, 682
- stationary hydrodynamic equations (Navier–Stokes equations), 1003
- stationary Khokhlov–Zabolotskaya equation, 649
- steady boundary layer equations for non-Newtonian fluids, 911
- steady hydrodynamic boundary layer equations for Newtonian fluid, 903
- steady laminar hydrodynamic boundary layer, 903
- steady-state hydrodynamic boundary layer equations, 903
- steady-state solutions, 1329
- stream function, 903, 909, 911, 915, 917, 929, 930, 932, 938, 1003, 1013, 1333
- strictly hyperbolic system, 1608, 1615
- string, 1628, 1690
- string variable, 1739
- strip condition, 1651, 1710
- structure, 1737
- of functional separable solutions, 1487
  - of generalized separable solutions, 1464
- subfunctions, 1741
- surface tension coefficient, 1262
- symbol, 1689
- symbolic and numerical solutions of nonlinear PDEs with Maple, Mathematica, and MATLAB, 1623
- symbolic math toolbox, 1736
- symmetric bivariate polynomial, 1444
- symmetries, 1439
- symmetries, of equations of steady hydrodynamic boundary layer, 1528
- of nonlinear second-order equations, 1516
  - of systems of equations of mathematical physics, 1527
- symmetry reductions based on generalized separation of variables, 1507
- system
- algebraic, 1441
  - characteristic, 1355
  - generic, 1754
  - graphics, 1736
  - hydrodynamic-type, diagonal form, 1236
  - hydrodynamic-type, nondiagonal form, 1236
  - hyperbolic, 1607, 1608, 1615
  - Lotka–Volterra, 1135
  - module, 1741
  - nonlinear, of first-order PDEs, 1659, 1719, 1720
  - nonlinear, of second-order PDEs, 1660, 1720
  - of coordinate functions, simplified scheme for constructing solutions, 1465
  - of gas dynamic type equations, 1403
  - of nonlinear elliptic equations, 1753
  - of two PDEs, 1402
  - semi-Hamiltonian, of quasilinear equations, 1236
  - strictly hyperbolic, 1608, 1615
- systems
- basic relations used in symmetry analysis, 1527
  - depending on arbitrary parameters, 1150
  - describing fluid flows in atmosphere, seas and oceans, 1223

systems (*continued*)

- first-order hydrodynamic, involving three or more equations, 1197
- first-order hyperbolic, of quasilinear equations, 1607
- gas dynamic type, linearizable with hodograph transformation, 1122, 1610
- gas dynamics, canonical form, 1611
- hydrodynamic-type, 1236
- hyperbolic  $n \times n$ , of conservation laws, 1614
- in form of conservation laws, 1607
- involving arbitrary functions, 1117
- involving arbitrary parameters, 1115
- involving third-order evolution equations, 1172
- mathematical physics, symmetries, 1527
- nonlinear, analytical solutions, 1659, 1719
- nonlinear, of many equations involving first derivatives with respect to  $t$ , 1348
- nonlinear, of partial differential equations, 1599
- nonlinear, of second-order PDEs, 1660, 1661, 1720, 1721
- nonlinear, of two equations, 1347
- nonlinear, of two equations involving first derivatives with respect to  $t$ , 1337
- nonlinear, of two equations involving second derivatives with respect to  $t$ , 1344
- nonlinear, Painlevé test, 1576
- of algebraic equations symmetric with respect to permutation of arguments, 1444
- of conservation laws of gas dynamic type, 1607
- of first-order equations describing convective mass transfer with volume reaction, 1602
- of general form, 1337
- of nonlinear elliptic PDEs in two space dimensions, 1752
- of nonlinear equations, 1557
- of nonlinear PDEs in one space dimension, 1745
- of second-order equations of reaction-diffusion type, 1620
- of two elliptic equations, 1185
- of two equations, 1122
- of two first-order partial differential equations, 1115
- of two parabolic equations, 1133
- of two quasilinear equations, 1165, 1607
- of two second-order elliptic equations, 1191
- of two second-order Klein–Gordon type hyperbolic equations, 1173
- ordinary differential equations, Painlevé test, 1569
- overdetermined, in one unknown, 1600
- overdetermined, of first-order equations in one unknown, 1599
- overdetermined, of two equations, 1599
- reduction to canonical form, 1611
- reducible to ordinary differential equations, 1603
- various coordinate, Euler equations, 1197
- various coordinate, Navier–Stokes, 1247

**T**

- table, 1629, 1691
- tanh-coth method, 1641, 1701
- telegraph equation, 494, 538, 583, 585
- tensor, 1691
- terminal value problem, 1383, 1386
- thin film equation, 985
- third-order equations, 857, 949
  - evolution, 1172
  - involving third-order mixed derivatives, 958
  - examples of finding exact solutions, 1465
- third-order Liouville-type equation, 972
- Thomas equation, 544
- three- and  $n$ -dimensional equations, 428
- three-argument functional equations of special form, 1497
- three-dimensional equations, 1240
  - involving arbitrary functions, 730
  - of ideal plasticity, 1240
- three-dimensional Khokhlov–Zabolotskaya equation, 752
- three-dimensional nonlinear Schrödinger equation of general form, 429
- three-dimensional Schrödinger equation with cubic nonlinearity, 428
- three-dimensional stagnation-point type flows, 1302
- three-soliton solution, KdV, 859
- Titov–Galaktionov method, 1477
- toolboxes, 1738
- toroidal vortex, 1278
- tractrix equation, 253
- transformation
  - auto-Bäcklund, 681, 1413, 1635, 1695
  - Boussinesq, 1289
  - classical hodograph, 1400
  - Cole–Hopf, 1573
  - Cole–Hopf, for Burgers equation, 1637, 1696
  - Crocco, 906, 909, 1422
  - Euler, 122, 346, 769, 957, 1403, 1407
  - first hodograph, 1399
  - Galileo, 1514
  - hodograph, 35, 212, 344, 1129, 1397
  - hodograph, for gas dynamic type systems, 1122, 1610
  - hodograph, nonclassical, 345, 1399
  - hodograph, second, 1400
  - Hopf–Cole, 187, 888, 1067, 1409, 1414
  - Legendre, 122, 767, 768, 770, 1403, 1406
  - Legendre, with many variables, 1408
  - Lorentz, 1514

- transformation (*continued*)  
 Martin, 775  
 Miura, 862, 868, 1410  
 nonclassical hodograph, 345, 1399  
 nonlocal, 1412  
 rotation, 1396  
 scaling, 1396, 1645, 1705, 1770  
 second hodograph, 1400  
 similarity, 1645, 1705  
 translation, 1396  
 von Mises, 761, 906, 909, 916, 937, 971, 1106, 1409, 1410
- transformations  
 Bäcklund, 1413, 1635, 1695  
 Bäcklund, canonic for evolution equations, 1420  
 Bäcklund, for second-order equations, 1413  
 based on conservation laws, 1425  
 contact, 1403  
 contact, for ordinary differential equations, 1403  
 contact, for partial differential equations, 1405  
 for constructing solutions, 1635, 1694  
 in plane, 1514  
 linear, 1396  
 local, for derivatives, 1526  
 of equations of mathematical physics, 1395  
 one-parameter, 1513  
 one-parameter, local properties, 1513  
 one-parameter, point, Lie groups, 1526  
 point, general form, 1395  
 point, one-parameter Lie groups, 1526  
 point, overview and examples, 1395  
 point, simple, 1396  
 preserving form of equations, 1439, 1445, 1450  
 scaling, invariance of equations, 1431  
 simple, 1446  
 simple, nonlinear point, 1396  
 translation, invariance of equations, 1430  
 translation, invariance of solutions, 1430
- transient fluid motion for whirlwind, 1258  
 transient motion of flat plate, 1251  
 translation transformation, 1396  
 transversality condition, 1380  
 traveling-wave solutions, 1429, 1602, 1615, 1620, 1637, 1659, 1697, 1720  
 ansatz methods, 1641, 1700  
 classical, 1431  
 functional equation, 1431  
 general form, 1429  
 generalized, 1487  
 generalized, general scheme for constructing, 1487  
 methods for constructing, 1641, 1700  
 nonclassical, 679, 690, 706
- Tricomi equation, 659  
 truncated expansions, 1571  
 two-body problem in celestial mechanics, 65  
 two-dimensional equations, 425, 1238  
 two-dimensional Euler equations for incompressible ideal fluid (plane flows), 1198  
 two-dimensional Khokhlov–Zabolotskaya equation, 749  
 two-dimensional linear heat equation, 1256  
 two-dimensional nonlinear Schrödinger equation of general form, 427  
 two-dimensional Schrödinger equation with cubic nonlinearity, 425  
 two-dimensional Schrödinger equation with power-law nonlinearity, 427  
 two-dimensional solutions in cylindrical coordinates (plane flows), 1270  
 two-dimensional solutions in rectangular Cartesian coordinates (plane flows), 1263  
 two-disk problem, 1291  
 two-soliton periodic solution, 492  
 two-soliton solution, 491, 869  
 KdV equation, 858  
 two classes of functions, 1690  
 two control structures, 1629, 1691  
 types of brackets, 1628, 1690, 1739  
 types of equations, 1389  
 types of numbers, 1628, 1690, 1740  
 types of quotes, 1628, 1690  
 Tzitzéica equation, 541
- ## U
- unassignment of definitions, 1690  
 unidirectional flows in tubes of various cross-sections, 1253  
 unidirectional plane flows, 1251  
 universal invariant, 1526  
 unnormalized Boussinesq equation, 990  
 unnormalized Burgers equation, 187  
 unnormalized Kadomtsev–Petviashvili equation, 1002  
 unnormalized Korteweg–de Vries equation, 865  
 unnormalized modified Korteweg–de Vries equation, 870  
 unsteady boundary layer equations  
 for Newtonian fluid, 917  
 for non-Newtonian fluids, 930  
 unsteady hydrodynamic boundary layer, 917  
 unsteady solutions, 1331  
 upwind explicit finite difference scheme, 1762  
 usage of several differential constraints, 1557  
 user-defined function, 1628, 1691, 1737, 1740  
 using integral relations for determining generalized solutions, 1364  
 using symmetries of equations for constructing one-parameter solutions, 1520  
 using symmetries of equations for finding exact solutions, 1520

**V**

V-shaped body, 1334  
 variable name, 1627, 1738  
 variant of modified Burgers–Korteweg–de Vries equation, 886  
 various reserved keywords, 1627, 1738  
 vector, 1629, 1691, 1741  
 vector and array indices, 1741  
 vector Burgers equation, 417  
 verifying exact solutions, 1667  
 viscosity solutions, 1365, 1366  
   based on test functions and differential inequalities, 1383  
   based on use of parabolic equation, 1382  
 viscous incompressible fluid, 1247  
 Volosov solution, 179  
 von Kármán equations (fourth-order elliptic equations), 1192  
 von Kármán flow, 1290  
 von Kármán-type rotationally symmetric flows, 1316  
 von Kármán-type rotationally symmetric motions, 1290  
 von Mises solution, 768  
 von Mises transformation, 761, 906, 909, 916, 937, 971, 1106, 1409, 1410  
 von Mises variables, 1106  
 von Mises yield criterion, 1238, 1239, 1240

**W**

wave  
   breaking, 1360  
   breaking effect, 26  
   centered rarefaction, 1359  
   cnoidal, 858  
   linear equation, 1392  
   nonlinear, model equation with damping, 6  
   nonlinear dispersive nondissipative, 857  
   nonlinear equation, 1400, 1519, 1536, 1673, 1678, 1723, 1727, 1764  
   overtun, 1360  
   rarefaction, 6, 26, 1360, 1360, 1611, 1758  
   rarefaction, for inviscid Burgers equation, 1757  
   Riemann simple, 1125, 1127, 1129  
   shock, 6, 26, 1675, 1126, 1128, 1362, 1615, 1616, 1758  
   shock, for inviscid Burgers equation, 1757  
   simple Riemann, 1609  
 weak solution, 1364, 1675, 1758  
 Weber equation, 1193  
 Weierstrass elliptic function, 176, 885, 988, 1122  
 Whitham rule of equal areas, 1363

**Y**

Yermakov equation, 309, 518