



1. Nonlinear Parabolic Equations

1.1. Nonlinear Heat Equations of the Form $\frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} + f(w)$

1. $\frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} + aw(1-w)$. *Fisher equation.*
2. $\frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} + aw - bw^3$. *Newell–Whitehead equation.*
3. $\frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} - w(1-w)(a-w)$. *FitzHugh–Nagumo equation.*
4. $\frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} + aw + bw^m$.
5. $\frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} + a + be^{\lambda w}$.
6. $\frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} + aw \ln w$.

1.2. Nonlinear Heat Equations of the Form $\frac{\partial w}{\partial t} = \frac{\partial}{\partial x} \left[f(w) \frac{\partial w}{\partial x} \right] + g(w)$

1. $\frac{\partial w}{\partial t} = a \frac{\partial}{\partial x} \left(w^m \frac{\partial w}{\partial x} \right)$. *Heat equation with a power-law nonlinearity.*
2. $\frac{\partial w}{\partial t} = a \frac{\partial}{\partial x} \left(w^m \frac{\partial w}{\partial x} \right) + bw$.
3. $\frac{\partial w}{\partial t} = a \frac{\partial}{\partial x} \left(w^m \frac{\partial w}{\partial x} \right) + bw^{m+1}$.
4. $\frac{\partial w}{\partial t} = a \frac{\partial}{\partial x} \left(w^m \frac{\partial w}{\partial x} \right) + bw^{1-m}$.
5. $\frac{\partial w}{\partial t} = a \frac{\partial}{\partial x} \left(w^{2n} \frac{\partial w}{\partial x} \right) + bw^{1-n}$.
6. $\frac{\partial w}{\partial t} = a \frac{\partial}{\partial x} \left(w^n \frac{\partial w}{\partial x} \right) + bw + c_1 w^m + c_2 w^k$.
7. $\frac{\partial w}{\partial t} = a \frac{\partial}{\partial x} \left(e^{\lambda w} \frac{\partial w}{\partial x} \right)$. *Heat equation with an exponential nonlinearity.*
8. $\frac{\partial w}{\partial t} = a \frac{\partial}{\partial x} \left(e^{\lambda w} \frac{\partial w}{\partial x} \right) + b + c_1 e^{\beta w} + c_2 e^{\gamma w}$.

$$9. \quad \frac{\partial w}{\partial t} = \frac{\partial}{\partial x} \left[f(w) \frac{\partial w}{\partial x} \right]. \quad \text{Nonlinear heat equation of general form.}$$

$$10. \quad \frac{\partial w}{\partial t} = \frac{\partial}{\partial x} \left[f(w) \frac{\partial w}{\partial x} \right] + g(w).$$

1.3. Other Nonlinear Parabolic Equations

$$1. \quad \frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} + w \frac{\partial w}{\partial x}. \quad \text{Burgers equation.}$$

$$2. \quad \frac{\partial w}{\partial t} + \sigma w \frac{\partial w}{\partial x} = a \frac{\partial^2 w}{\partial x^2} + b_0 + b_1 w + b_2 w^2 + b_3 w^3.$$

$$3. \quad \frac{\partial w}{\partial t} = \frac{1}{x^n} \frac{\partial}{\partial x} \left[x^n f(w) \frac{\partial w}{\partial x} \right] + g(w).$$

$$4. \quad \frac{\partial w}{\partial t} = \frac{\partial}{\partial x} \left[f(w) \left(\frac{\partial w}{\partial x} \right)^n \right] + g(w).$$

1.4. Nonlinear Schrodinger Equations

$$1. \quad i \frac{\partial w}{\partial t} + \frac{\partial^2 w}{\partial x^2} + k|w|^2 w = 0. \quad \text{Schrodinger equation with a cubic nonlinearity.}$$

$$2. \quad i \frac{\partial w}{\partial t} + \frac{\partial^2 w}{\partial x^2} + A|w|^{2n} w = 0. \quad \text{Schrodinger equation with a power-law nonlinearity.}$$

$$3. \quad i \frac{\partial w}{\partial t} + \frac{\partial^2 w}{\partial x^2} + f(|w|)w = 0. \quad \text{Schrodinger equation of general form.}$$

The EqWorld website presents extensive information on solutions to various classes of ordinary differential equations, partial differential equations, integral equations, functional equations, and other mathematical equations.