



Exact Solutions > Nonlinear Partial Differential Equations >
Second-Order Parabolic Partial Differential Equations > FitzHugh–Nagumo Equation

$$3. \quad \frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} - w(1-w)(a-w).$$

FitzHugh–Nagumo equation. This equation arises in genetics, biology, and heat and mass transfer.
Solutions:

$$w(x, t) = \frac{A \exp(z_1) + aB \exp(z_2)}{A \exp(z_1) + B \exp(z_2) + C},$$
$$z_1 = \pm \frac{\sqrt{2}}{2} x + \left(\frac{1}{2} - a\right)t, \quad z_2 = \pm \frac{\sqrt{2}}{2} ax + a\left(\frac{1}{2}a - 1\right)t,$$

where A , B , and C are arbitrary constants.

See also: [Newell–Whitehead equation](#) (a special case of the Fitzhugh–Nagumo equation).

References

- Kawahara, T. and Tanaka, M.**, Interactions of traveling fronts: an exact solution of a nonlinear diffusion equations, *Phys. Lett.*, Vol. 97, p. 311, 1983.
- Nucci, M. C. and Clarkson, P. A.**, The nonclassical method is more general than the direct method for symmetry reductions. An example of the Fitzhugh–Nagumo equation, *Phys. Lett. A*, Vol. 164, pp. 49–56, 1992.
- Polyanin, A. D. and Zaitsev, V. F.**, [Handbook of Nonlinear Partial Differential Equations](#), Chapman & Hall/CRC, Boca Raton, 2004.

FitzHugh–Nagumo Equation

Copyright © 2004 Andrei D. Polyanin

<http://eqworld.ipmnet.ru/en/solutions/npde/npde1103.pdf>