

Computational physics

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The Van der Pol oscillator (named after the dutch engineer Balthasar Van der Pol) is a non-linearly damped oscillator widely used to model the behaviour of some electronic circuits. The equation that represents such system is:

$$\frac{d^2x}{dt^2} - a(1 - x^2)\frac{dx}{dt} + x = 0$$

The student should solve the above equation with a second order Runge-Kutta time scheme and initial conditions: $x(t = 0) = 0$ and $\frac{dx}{dt}(t = 0) = 1.0$, for different choices of the a parameter.

The student should describe qualitatively how the shape of the solution changes for values of a given by: $a = 0.1, 0.5, 1.0, 5.0, 10.0$ and quantitatively see how the amplitude and the period of the oscillation change for the same values of the parameter, in regime conditions.