3D- ODE examples in 3D-XplorMath*

See First: `About This Category` (DocumentationMenu)

3D 1st Order:

linear: $$\begin{pmatrix} x \\ y \\ z \end{pmatrix}' = \begin{pmatrix} aa & bb & cc \\ dd & ee & ff \\ gg & hh & ii \end{pmatrix} \cdot \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

Lorenz: $$\begin{pmatrix} x \\ y \\ z \end{pmatrix}' = \begin{pmatrix} -10x + 10y \\ aa\,x - y - xz \\ -(8/3)z + xy \end{pmatrix}$$

Rikitake: $$\begin{pmatrix} x \\ y \\ z \end{pmatrix}' = \begin{pmatrix} -bb\,x + yz \\ -aa\,x - bb\,y + xz \\ 1 - xy \end{pmatrix}$$

Rössler: $$\begin{pmatrix} x \\ y \\ z \end{pmatrix}' = \begin{pmatrix} -y - z \\ x + aa\,y \\ bb - cc\,z + xz \end{pmatrix}$$

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* This file is from the 3D-XplorMath project. Please see:

http://3D-XplorMath.org/

3D 2nd Order: $(x' = u, y' = v, z' = w)$

coupled Oscillator:

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix}'' = \begin{pmatrix} -aa^2 x + dd(y-x) + ee(z-x) - gg\,u \\ -bb^2 y + dd(x-y) + ff(z-y) - hh\,v \\ -cc^2 z + ee(x-z) + ff(y-z) - ii\,w \end{pmatrix}$$

forced Oscillator:

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix}'' = \begin{pmatrix} -aa^2 x + bb\cos(cc \cdot t) \\ -dd^2 y + ee\cos(ff \cdot t) \\ -gg^2 z + hh\cos(ii \cdot t) \end{pmatrix}$$

The ODE for a **charged particle** in a magnetic field M:
$\vec{x}\,' = \vec{u},\ \vec{x}\,'' = \vec{u}\,' = \vec{u} \times M(x,u)$, *charge and mass are* 1.

const Magnetic Field: $M(\vec{x}) := (aa, bb, cc)^t$

Magnetic Field of straight wire:

$$\vec{wire} := (aa, bb, cc)^t / \sqrt{aa^2 + bb^2 + cc^2}$$
$$\vec{px} := \vec{x} - \langle \vec{x}, \vec{wire} \rangle \cdot \vec{wire},\ rr := |\vec{px}|^2$$
$$M(\vec{x}) := dd/rr \cdot (\vec{wire} \times \vec{px})$$

Toroidal Magnetic Field:

$$M(\vec{x}) := (2y,\ -2x,\ 0)/(x^2 + y^2)$$

Magnetic Dipole Field:

$$rr := x^2 + y^2 + z^2$$
$$eDOTp := aa\,x + bb\,y + cc\,z$$

$$M(\vec{x}) := \left(\frac{3x}{rr - aa}, \frac{3y}{rr - bb}, \frac{3z}{rr - cc}\right)\frac{eDOTp}{rr^{3/2}}$$