

Oscillateur de Van der Pol

on choisit L comme unité de longueur et $\frac{1}{\omega_0}$ comme unité de temps

$$eq := \frac{d}{dt} \frac{d}{dt} x(t) + \alpha \frac{d}{dt} x(t) (x(t)^2 - 1) + x(t) = 0$$

$$\frac{d^2}{dt^2} x(t) + \alpha \left(\frac{d}{dt} x(t) \right) (x(t)^2 - 1) + x(t) = 0 \quad (1)$$

$$ics := x(0) = 4, D(x)(0) = 0$$

$$x(0) = 4, D(x)(0) = 0 \quad (2)$$

$$sol := dsolve(\{subs(\alpha = 0.25, eq), ics\}, numeric, maxfun = 0)$$

$$\text{proc}(x_rkf45) \dots \text{end proc} \quad (3)$$

$$sol(0)$$

$$\left[t = 0., x(t) = 4., \frac{d}{dt} x(t) = 0. \right] \quad (4)$$

$$sol(1)$$

$$\left[t = 1., x(t) = 3.16951137337484, \frac{d}{dt} x(t) = -1.19644251862886 \right] \quad (5)$$

$$tt := \text{Array}(1..1001, datatype = \text{float}[8])$$

$$\left[\begin{array}{l} 1 .. 1001 \text{ Array} \\ \text{Data Type: float}_8 \\ \text{Storage: rectangular} \\ \text{Order: Fortran_order} \end{array} \right] \quad (6)$$

$$xx := \text{Array}(1..1001, datatype = \text{float}[8])$$

$$\left[\begin{array}{l} 1 .. 1001 \text{ Array} \\ \text{Data Type: float}_8 \\ \text{Storage: rectangular} \\ \text{Order: Fortran_order} \end{array} \right] \quad (7)$$

$$xp := \text{Array}(1..1001, datatype = \text{float}[8])$$

$$\left[\begin{array}{l} 1 .. 1001 \text{ Array} \\ \text{Data Type: float}_8 \\ \text{Storage: rectangular} \\ \text{Order: Fortran_order} \end{array} \right] \quad (8)$$

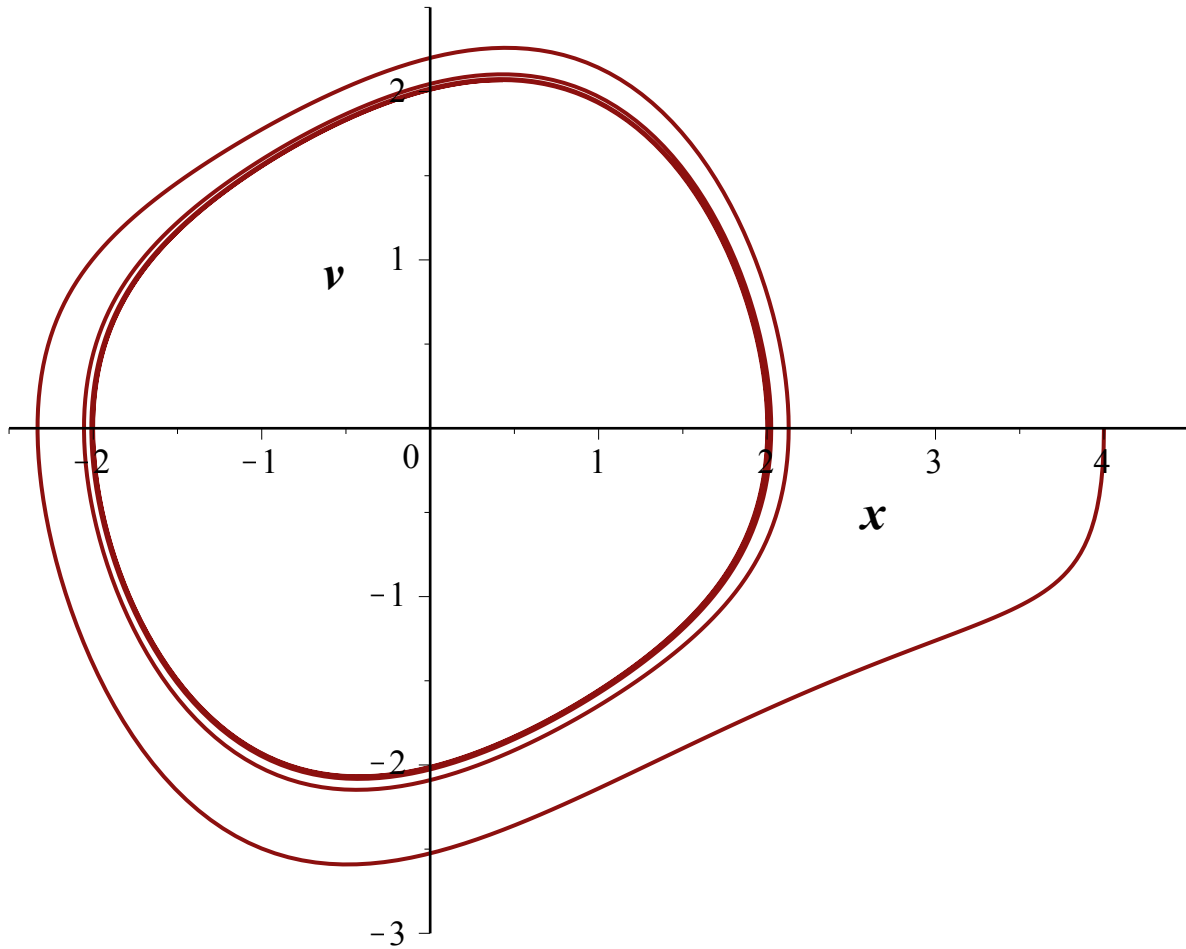
for ii **from** 1 **to** 1001 **do**
 $tt[ii] := \text{evalf}((ii - 1) \cdot 0.01 \cdot \text{Pi});$
 $xx[ii] := \text{rhs}(sol(tt[ii]))[2];$
 $xp[ii] := \text{rhs}(sol(tt[ii]))[3];$
end:

$pl := \text{plot}(xx, xp)$

PLOT(...)

(9)

```
plots[display](p1, scaling = constrained, coordinateview = [-2.5 .. 4.5, -3 .. 2.5], labels  
= ["      x", "\n\nv"], labelfont = [TIMES, BOLDITALIC, 14])
```



```
ics := x(0) = 0.02, D(x)(0) = 0
```

$x(0) = 0.02, D(x)(0) = 0$

(10)

```
sol := dsolve({subs(alpha = 0.25, eq), ics}, numeric, maxfun = 0)
```

proc(x_rkf45) ... end proc

(11)

```
sol(0)
```

$\left[t = 0., x(t) = 0.020000000000000000, \frac{d}{dt} x(t) = 0. \right]$

(12)

```
sol(1)
```

$\left[t = 1., x(t) = 0.0100038733711061, \frac{d}{dt} x(t) = -0.0191230231575529 \right]$

(13)

```
for ii from 1 to 1001 do
```

```
  tt[ii] := evalf((ii - 1) * 0.03 * Pi);
```

```
  xx[ii] := rhs(sol(tt[ii])[2]);
```

```
  xp[ii] := rhs(sol(tt[ii])[3]);
```

```
end:
```

```
p2 := plot(xx, xp)
```

PLOT(...)

(14)

```
plots[display](p2, scaling = constrained, coordinateview = [-2.5 ..2.5, -2.5 ..2.5], labels = ["x ",  
"\n\nv"], labelfont = [TIMES, BOLDITALIC, 14])
```

