SYSTEM of TWO DIFFERENTIAL EQUATION of 1st ORDER - NUMERICAL RESULTS by THE METHOD of RUNGE-KUTTA - v1.01

The program finds for a system of two differential equation of 1st order given as x'=f(t,x,y) and y'=g(t,x,y) the numerical approximation by the method of RUNGA-KUTTA 4th order and provides a plot of the result ( x’ and y’ stand for *dx/dt* and *dy/dt* !)

Necessary inputs are both functions, the interval t1<=t<=t2 to be scrutinized, the increment of steps h and the initial conditions t0, x0(t0), y0(t0). The results t, x, y are stored in the lists L1, L2 and L3. To display the curves ( and trace them ), press [graph] ( [trace] ). x(t) is displayed in BLUE, while y(t) is represented in MAGENTA.

Start RUKUTXY, then follow the prompts to make your input (see example).

*EXAMPLE:*

A prey-predator-model ( x(t): population of prey, y(t): population of predators, x’/x: growth rate

of prey, y’/y: growth rate of predators ) is described by: x’ = 3\*x - x\*y and y’ = x\*y -4\*y.

Find the numerical approximations within 0 <= t <= 2 for the initial conditions:

t=0, x(0) =2 , y(0) = 1. Assume h = 0.01 as increment .

Start RUKUTXY, then enter on the prompts:

1:New system enter

2:Last system

x’ (t,x,y)= 3X-XY enter

y’ (t,x,y)= XY-4Y enter

Initial t0= 0

Initial x0= 2 enter

Initial y0= 1 enter

Intervall t1<=t<=t2

t1 : 0 enter

t2 : 2 enter

Increment h: .01 enter

The calculation takes about 40 sec, then the screen displays: [ t x y ]=L1  L2 L3

Press [stat], then 1:Edit . These commands open the list screen and show the result:

L1 L2  L3

0 2 1

0.01 2.040604026 0.9803967034

….. ……. …….

0.1 2.464255905 0.8370304405

….. ……. ……..

0.31 3.95555296 0.6992958699 minimum predator

….. ……. …….

0.81 9.54891417 2.9838154 maximum prey

….. ……. …….

1.11 3.91606988 8.016022977 maximum predator

…… ……. …….

1.57 1.17778385 2.996014348 minimum prey

…… ……. …….

2 1.99835658 1.00082286 new period ( t = 2 )

Press [graph] to see both curves (BLUE for x, MAGENTA for y). To change conditions, start again and select 2:Last system. You may now change the initial conditions and the interval to be analyzed.

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