Example.- Help Implementation of the Radau 5 code (E. Hairer & G. Wanner) for initial value problems of dimension two (only for academic purposes).

$\mathbf{y}' =$

$\mathbf{y}($ $) =$

$J(t, \mathbf{y}) =$

$tol_a =$ $tol_r =$ $h_0 =$ $t_{\text{end}} =$

Example 1 **Example 2** **Integra** **Dibuja**

RESULTS

$\mathbf{y}($ $) \simeq ($, $)$

nfcn= njac= Na= Nr= LU= Sol=

xmin = xmax = ymin = ymax =

1. Help

The format used to introduce arrays in the fields for y' (derivative function) and $J(t, y)$ (Jacobian matrix) is similar to `matlab`

- tol_a absolute tolerance
- tol_r relative tolerance
- h_0 initial step size
- t_{end} end point of the interval integration.

After perform the numerical integration, it is possible to plot some figures in the square window of page 2. Select the plot of the combo menu and press the $\boxed{\textbf{Plot}}$ button

- xy Phase space
- tx y_1 against t
- ty y_2 against t
- tn Number of iterations used for solving the non linear system againts t. Each horizontal line represents 2 iterations.

The scales of the figure can be controled by (xmin, xmax) for y_1 and (ymin, ymax) for y_2.

After filling all fields, or put $\boxed{\textbf{Example 1}}$, $\boxed{\textbf{Example 2}}$ buttons, press the $\boxed{\textbf{Integrate}}$ button and you will obtain the results of the numerical integration

- nfcn number of evaluations of the derivative function
- njac number of Jacobian evaluations
- Na accepted steps
- Nr rejected steps
- LU number of factorizations LU
- Sol number of solved linear systems

To introduce functions, the format used is given by:
- For multiplication, use `*`. Write `21*x` for $21x$
- `4*x^2` for $4x^2$ and `12*x^-5` for $12x^{-5}$.
- `sqrt(5)` for $\sqrt{5}$.
- Parentheses are used to pass parameters, e.g. `sin(x)` for $\sin x$.
- Allowed functions are: abs, sin, cos, tan, cot, sec, csc, exp, ln, log, asin, acos, atan.
- `(sin(x))^2` for $\sin^2 x$.
- For the absolute value, use $\text{abs}(\cos(x))$ or $|\cos(x)|$.
- π and e as PI and E respectively.