Computational Mathematics - Problem Sheet 3

MT 2017

Once you have completed all exercises, use the `publish` command to generate an .html or .pdf file of your solutions. Print it out and hand it to your demonstrator at the beginning of the next session.

1. Consider the initial value problem

$$(t+1)^2\frac{\mathrm{d}^2u}{\mathrm{d}t^2} - 3(t+1)\frac{\mathrm{d}u}{\mathrm{d}t} + t = 1, \qquad u(0) = 1, \qquad u'(0) = 1. \tag{1}$$

   Solve (1) in MATLAB using `dsolve`.

2. Now (by hand) write (1) as a first-order system of ODEs by making the substitution $v = \frac{\mathrm{d}u}{\mathrm{d}t}$.[1]

3. Download the files `ode_example.m` and `ode_template.m` from the course webpage. Using `ode_example.m` as a guide (and the MATLAB help pages, if necessary), modify `ode_template.m` to numerically solve the system of equations you obtained in Q2 in the range $t \in [0, 1]$.

4. Plot the solutions of Q1 and Q3 on the same pair of labelled axes and include a legend to distinguish between them. Ensure you include your name and college in the title.

[1] There is no need to show this in your solutions, but it will be necessary in order to complete Q3.