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Assignment 10

- Programming exercises -

Upload your solution until Mo, 03 July 2023, 03:00 pm.

Programming exercise 10.1 **(6 points)**

Consider an initial value problem

$$y' = -Ay, \qquad y(0) = y_0$$

with $A \in \mathbb{R}^{n\times n}$, $y_0 \in \mathbb{R}^n$.

Write two `Matlab` function files `explicitEulerVector` and `implicitEulerVector` which take as input the matrix A, the initial value y_0, the end time t_{end} and the stepsize h and compute a numerical solution of the IVP at time t_{end} using explicit Euler's method and implicit Euler's method respectively. The output of the `Matlab` functions should not only be the solution of the problem but also the intermediate values for each timestep.

Programming exercise 10.2 **(4 points)**

Using the two function files from above, compute a numerical solution of the following initial value problem

$$y' = \begin{pmatrix} -4 & 6 \\ 31 & -189 \end{pmatrix} y, \qquad y(0) = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

with the end time $t_{end} = 2$ and stepsize $h = \{0.01, 0.02\}$.

For each of these stepsizes, plot the polygonal chain which connects the intermediate values y_i until a solution at t_{end} is reached. What do you observe? Make a comment in your script.

Hint: *Mind the minus sign in the IVP!*