Qn3 (10 marks)

Deadline 9 Sep (Sat), 2359 hrs

A 2nd order IVP is given by $\ddot{Y} + 4Y = \cos 2t \quad , \quad Y(0) = 1 \, , \dot{Y}(0) = 0$

Exact solution: $Y = \cos 2t + \frac{1}{4} t \sin 2t$

Hint:

A 2nd order IVP can be written as a system of 1st order IVP equations, and solved with a 1st order numerical scheme by writting it as $\boldsymbol{Z}_{n+1} = \boldsymbol{A}\, \boldsymbol{Z}_n$. For a stable numerical scheme, the *magnitude* of the maximum eigenvalue of **A** should not be larger than 1.

There is an 'eig' function in Matlab to determine the eigenvalues of a matrix.

CE5377 students:

- Solve the IVP as a system of 1st order IVP with the Euler Explicit methods.
- Comment on the accuracy and stability.

CE6077 students:

- Solve the IVP as a system of 1st order IVP with the (i) Euler Explicit and (ii) RK4 methods.
- Comment on the accuracy and stability issues of the two methods