

Oral Exam for All Round: Applied and Computational Mathematics 2017

1. Consider a vector-valued ODE:

$$m_t = -a \times m,$$

where $a = (a_1, a_2, a_3)^T$ is a non-zero real constant vector, and $m(t) = (m_1(t), m_2(t), m_3(t))^T$ is the unknown vector-valued function.

Consider a uniform time sequence

$$0 = t_0 < t_1 < \cdots < t_k < \cdots,$$

with $t_k = k\Delta t$, and the explicit time marching scheme:

$$\frac{m^{n+1} - m^n}{\Delta t} = -a \times m^n,$$

- (a) Analyse the stability of the scheme.
- (b) Propose a numerical strategy to improve the scheme so that the new scheme has better stability.