

Ex. 5.2

Consider the matrix equation:

$$X^2 - A = 0$$

and the matrix-Newton method:

$$\begin{cases} X_0 = A \\ X_{k+1} = \frac{1}{2} (X_k + X_k^{-1} A) \end{cases} \quad \odot$$

$k=0, 1, 2, \dots$

a) Write a Matlab file matrixNewton.m that defines a matrix A and performs the iterations in \odot .

b) Test matrixNewton.m^{*} for the following matrices:

i) $\begin{pmatrix} 4 & 9 \\ -2 & -3 \end{pmatrix}$, ii) $\begin{pmatrix} 1 & -1 \\ 0 & 3 \end{pmatrix}$, iii) $\begin{pmatrix} 1 & 3 \\ 4 & 2 \end{pmatrix}$,

iv) $\begin{pmatrix} 10 & 1 \\ 2 & 3 \end{pmatrix}$, v) $\begin{pmatrix} 10 & 7 & 8 & 7 \\ 7 & 5 & 6 & 5 \\ 8 & 6 & 10 & 9 \\ 7 & 5 & 9 & 10 \end{pmatrix}$.

c) Calculate the eigenvalues of the matrices in i), ..., iv). Check whether the stability property^{**} for matrix-Newton is satisfied.

* Use 20 iteration steps.

** See lecture notes Day 5.