

Lab exercises
Degree in mechanical engineering
AY 2016-17

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Solve the following exercises in Matlab.

1. Write an M-function that implements the iteration function of the **Newton's method** (for finding the zero of a function f in an interval $[a, b]$).
2. Consider the function $f(x) = e^x - 4x^2$. Write a Matlab script that
 - plot the function in $[-2, 5]$ and observe that in this interval the function has 3 zeros: $\xi_1 \in (-1, 0)$, $\xi_2 \in (0, 1)$ and $\xi_3 \in (4, 4.5)$;
 - Find ξ_1 with the **bisection method**, ξ_2 with **Newton's method** and ξ_3 with the **fixed point iteration** $x_{i+1} = \log(4x_i^2)$. Does this last method converge for every initial point x_0 ?

3. Take the function

$$f(x) = x^2 - c, \quad c \geq 0 \tag{1}$$

and the following two **iteration functions**:

(a)

$$g_1(x) = x - \frac{x^2 - c}{2x}.$$

(b)

$$g_2(x) = x - \frac{x^2 - c}{2x} - \frac{\left(x - \frac{x^2 - c}{2x}\right)^2 - c}{2x}.$$

Study the convergence of these two iterative methods.

In particular take $c = 2$ or $c = 3$. Then the problem reduces in finding the $\pm\sqrt{2}$ or $\pm\sqrt{3}$.

Time: **2 hours**.