

MR-5215 – Otimização Aplicada ao Projeto de Sistemas Mecânicos

8^a Assignment

(it can be done by a group of 2 students)

Due to: 29/05/23

Consider a mechanical system modeled by the linear system below:

$$[K(U)]\{U\} = \{F\} \Rightarrow \begin{bmatrix} A_1 u_1 & (2 - A_1^2) u_2 \\ (2 - A_1^2) u_1 & (4 + 3A_1) u_2 \end{bmatrix} \begin{Bmatrix} u_1 \\ u_2 \end{Bmatrix} = \begin{bmatrix} A_1 & 2 - A_1^2 \\ 2 - A_1^2 & 4 + 3A_1 \end{bmatrix} \begin{Bmatrix} u_1^2 \\ u_2^2 \end{Bmatrix} = \begin{Bmatrix} 3/A_1^2 \\ 5/A_1^2 \end{Bmatrix} \text{ where } A_1=1$$

Displacements u_1 and u_2 are positive. Determine the **numerical value** of the sensitivity for function $f=3u_1+2u_2$ in relation to A_1 by using:

- analytical method;
- semi-analytical method ($\Delta A_1=0,01$);
- finite difference method ($\Delta A_1=0,01$);

(**hint:** solve for $a=u_1^2$ and $b=u_2^2$ and take the square root to obtain u_1 and u_2)