

INSTITUTO TECNOLÓGICO DE AERONÁUTICA

MP-288 - Matlab Exercises

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1) Solve for x the linear system $Ax=b$, considering:

$$A = \begin{bmatrix} 1.5 & 3 & 4.8 & 5.3 \\ 3.2 & 2.5 & 4.9 & 8.5 \\ 1.9 & 5.6 & 0.4 & 10 \\ 1.9 & 0.6 & 8.2 & 1 \end{bmatrix}, b = \begin{pmatrix} 5.3 \\ 6.9 \\ 7.1 \\ 4.2 \end{pmatrix}$$

Definimos as variáveis de acordo com o enunciado:

$$A := \begin{pmatrix} 1.5 & 3 & 4.8 & 5.3 \\ 3.2 & 2.5 & 4.9 & 8.5 \\ 1.9 & 5.6 & 0.4 & 10 \\ 1.9 & 0.6 & 8.2 & 1 \end{pmatrix} \quad b := \begin{pmatrix} 5.3 \\ 6.9 \\ 7.1 \\ 4.2 \end{pmatrix}$$

Invertamos a matrix A

$$A^{-1} = \begin{pmatrix} -2.147 & -0.009 & 1.024 & 1.212 \\ -0.592 & -0.441 & 0.63 & 0.579 \\ 0.453 & 0.004 & -0.23 & -0.134 \\ 0.721 & 0.248 & -0.438 & -0.549 \end{pmatrix}$$

$$c := A^{-1} \cdot b \quad c = \begin{pmatrix} 0.9 \\ 0.7 \\ 0.2 \\ 0.1 \end{pmatrix}$$

2) Consider the variables $a = \pi$, $b = 2.3$ and $c = 5$ and the function:

$$f(x, y) = ac(\sin x \sin y) + b(x^2 + xy + y^2) + e^x.$$

Calculate the gradient of the function at the point $(x, y) = (2, 3)$.

Definimos conforme enunciado:

$$a := \pi \quad b := 2.3 \quad c := 5$$

$$f(x, y) := a \cdot c \cdot (\sin(x) \cdot \sin(y)) + b \cdot (x^2 + x \cdot y + y^2) + e^x$$

Derivamos a função f :

$$f(x, y) := \begin{pmatrix} \frac{d}{dx} f(x, y) \\ \frac{d}{dy} f(x, y) \end{pmatrix}$$

Calculando simbolicamente temos:

$$f(x, y) = \begin{pmatrix} e^x + 4.6 \cdot x + 2.3 \cdot y + 5 \cdot \pi \cdot \cos(x) \cdot \sin(y) \\ 2.3 \cdot x + 4.6 \cdot y + 5 \cdot \pi \cdot \sin(x) \cdot \cos(y) \end{pmatrix}$$

Para um ponto definido temos:

$$f(2, 3) = \begin{pmatrix} 22.6 \\ 4.3 \end{pmatrix}$$

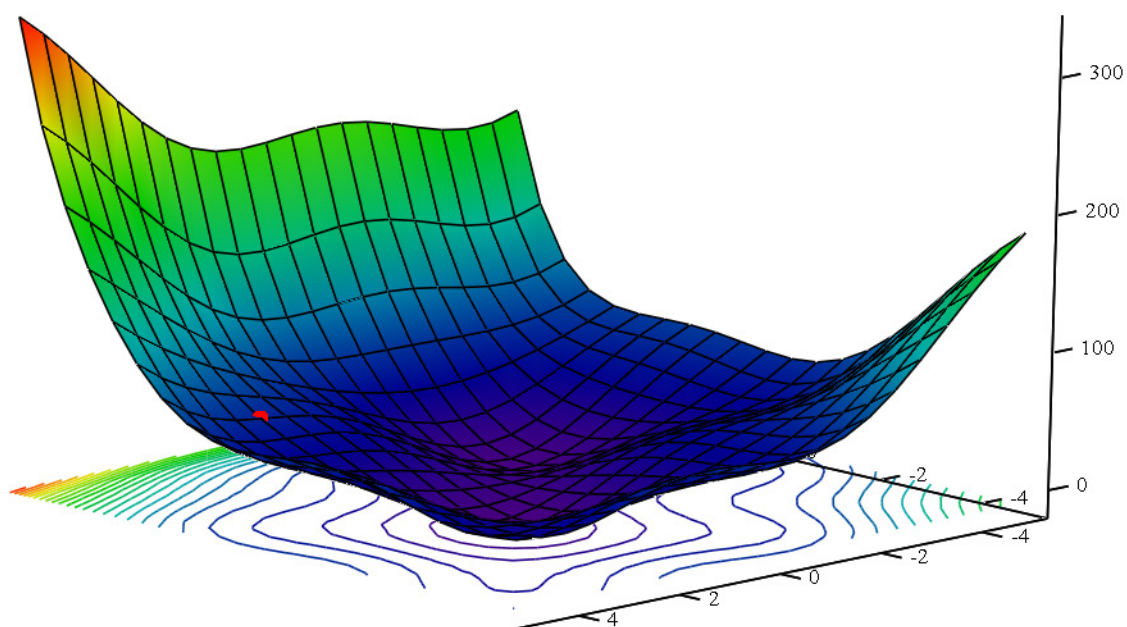
3) Plot the function $f(x,y)$ inside the interval $x, y = [-5, 5]$.

Usamos a ferramenta de plot do Mathcad:

Plotamos o ponto

$X := (2)$ $Y := (3)$ $Z := (f(2,3))$

Plot Example



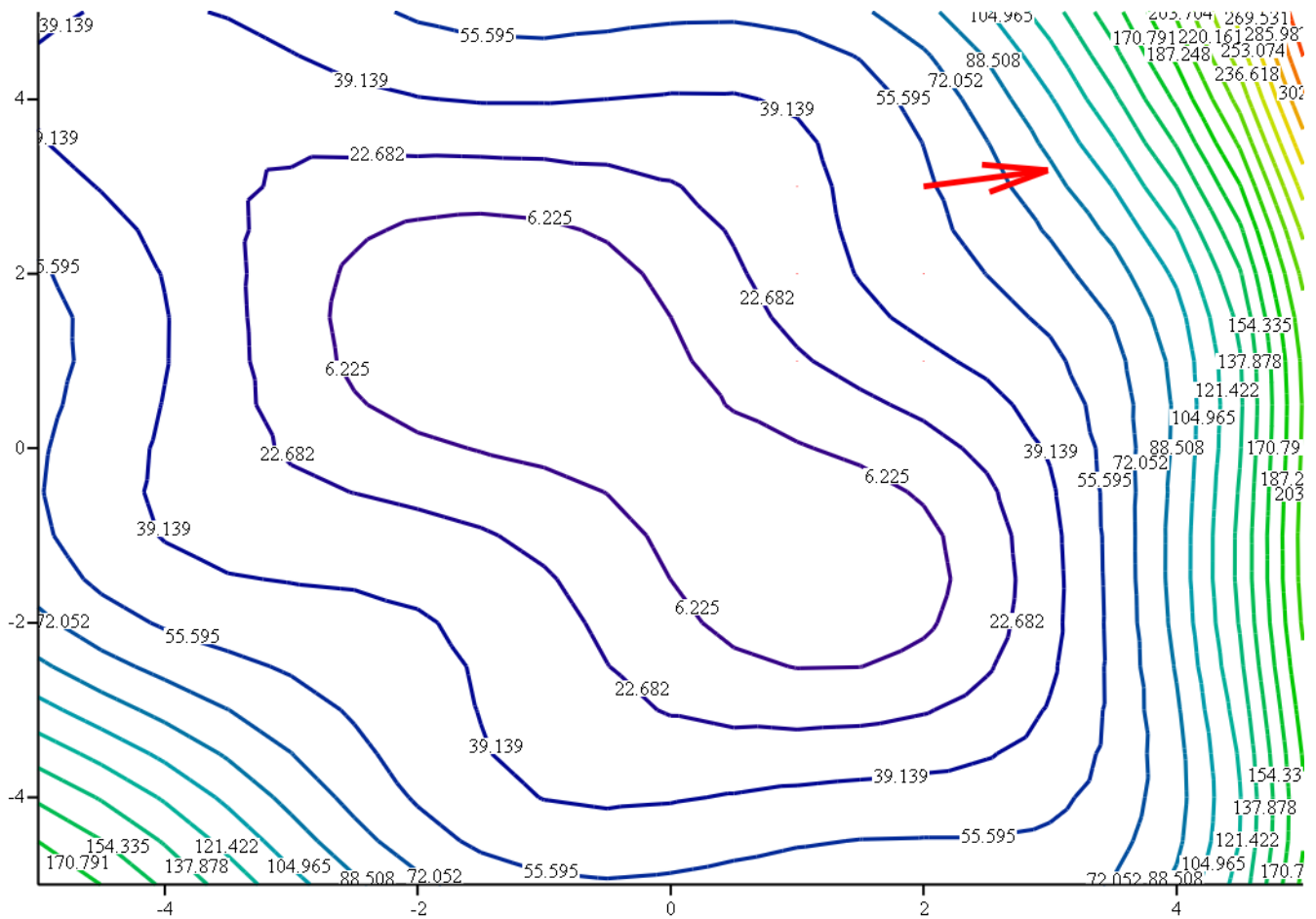
$f, f(X, Y, Z)$

4) Plot 20 contours of the function $f(x,y)$, the point $(x,y) = (2,3)$ and the function gradient at this point.

O gradiente no ponto $(2,3)$ pode ser definido como :

$$V_{x,3} := f(2,3)_1 \quad V_{y,3} := f(2,3)_2$$

Plotando:



$f, (V_x, V_y)$