Special Edition

Design Project 1
Dynamically Tuned Mass Launcher

ENGN0040: Dynamics and Vibrations

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Example 2: Minimization with upper/lower bounds on variables

Use the 'fmincon' MATLAB function to find the minimum value of $z(x,y) = \sin(x)\cos(y)$ subject to constraints $2 \le x \le 4$ $0 \le y \le 4$

Goal: Re-write in vector / matrix form

(1) Store variables x, y in a vector

$w = [\,x,\ y\,]$

(2) Write upper & lower bounds in vector form

$$\underbrace{\begin{bmatrix} 2 \\ 0 \end{bmatrix}}_{w_{min}} \le \underbrace{\begin{bmatrix} x \\ y \end{bmatrix}}_{w} \le \underbrace{\begin{bmatrix} 4 \\ 4 \end{bmatrix}}_{w_{max}}$$

For MATLAB $w_{min} \le w \le w_{max}$

Example 3: Minimization with bounds and linear constraints

Use the 'fmincon' MATLAB function to find the minimum value of $z(x,y) = \sin(x)\cos(y)$ subject to constraints $x \geq -2$ $y \geq -1$ $4x+3y \leq 6$ $-4x+3y \leq 8$

As before store x, y in vector $w = [x, y]$

(1) Upper / Lower bounds $\underbrace{\begin{bmatrix} -2 \\ -1 \end{bmatrix}}_{w_{min}} \leq \underbrace{\begin{bmatrix} x \\ y \end{bmatrix}}_{w} \leq \underbrace{\begin{bmatrix} \infty \\ \infty \end{bmatrix}}_{w_{max}}$

(3) Inequalities:

$$\underbrace{\begin{bmatrix} 4 & 3 \\ -4 & 3 \end{bmatrix}}_{[A]} \underbrace{\begin{bmatrix} x \\ y \end{bmatrix}}_{w} \leq \underbrace{\begin{bmatrix} 6 \\ 8 \end{bmatrix}}_{b}$$

For MATLAB $[A]\, w \leq b$