

# RBE 500 Homework #4

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## Problem 4.6

Given  $R = R_{x,\theta} R_{y,\phi}$ , compute  $\frac{\partial R}{\partial \phi}$ . Evaluate  $\frac{\partial R}{\partial \phi}$  at  $\theta = \frac{\pi}{2}$ ,  $\phi = \frac{\pi}{2}$ .

### Solution

$$\frac{\partial}{\partial \phi} (R_{x,\theta} R_{y,\phi}) = R_{x,\theta} \frac{\partial}{\partial \phi} (R_{y,\phi})$$

Using the the fact that  $\frac{d}{d\theta} (R_{y,\theta}) = S(j)R_{y,\theta}$ ,

$$R_{x,\theta} \frac{\partial}{\partial \phi} (R_{y,\phi}) = R_{x,\theta} S(j) R_{y,\phi} = R_{x,\theta} \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ -1 & 0 & 0 \end{bmatrix} \begin{bmatrix} \cos \phi & 0 & \sin \phi \\ 0 & 1 & 0 \\ -\sin \phi & 0 & \cos \phi \end{bmatrix}$$