

### Example Static Force Analysis

- Problem is from Engineering Mechanics Statics, 5th Edition, Meriam
- Sample Problem 3/5 on page 143 (shown on page-2 of this doc)

#### Unit Vectors

$$i := \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \quad j := \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \quad k := \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

#### Position Vectors

$$r_{AG} := -1 \cdot i - 3 \cdot j + 1.5 \cdot k$$

$$r_{AB} := -2 \cdot i - 6 \cdot j + 3 \cdot k$$

#### Applied Load

$$W := -1962 \cdot k$$

#### Method-1) Using Solve Evaluation with Bx and By as Variables

$$\text{MomentSum}(B_x, B_y) := r_{AB} \times (B_x \cdot i + B_y \cdot j) + r_{AG} \times W = 0 \cdot i + 0 \cdot j + 0 \cdot k$$

$$\text{MomentSum}(B_x, B_y) \rightarrow \begin{bmatrix} 5886 - 3 \cdot B_y \\ 3 \cdot B_x - 1962 \\ 6 \cdot B_x - 2 \cdot B_y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \xrightarrow{\text{solve}, B_x, B_y} [654 \quad 1962]$$

#### Method-2) Using Solve Evaluation with Bx and By as Variables within Function B

- Why Doesn't this work???

#### Reaction Load

$$B(B_x, B_y) := B_x \cdot i + B_y \cdot j$$

$$\text{MomentSumTest}(B) := r_{AB} \times (B) + r_{AG} \times W = 0 \cdot i + 0 \cdot j + 0 \cdot k$$

The following gives the same symbolic evaluation as Method-1 (good) but then a numeric result is not returned when calling the "solve" routine (bad).

$$\text{MomentSumTest}(B(B_x, B_y)) \rightarrow \begin{bmatrix} 5886 - 3 \cdot B_y \\ 3 \cdot B_x - 1962 \\ 6 \cdot B_x - 2 \cdot B_y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \xrightarrow{\text{solve}, B_x, B_y} \text{undefined}$$

The following doesn't work at all.

$$\boxed{\text{MomentSumTest}(B)} \rightarrow ? \xrightarrow{\text{solve}, B_x, B_y} ?$$

#### Method-3) Using "Isolve" - Note that this doesn't present / read as well as method 1 & 2

$$M := \begin{bmatrix} 0 & -3 \\ 3 & 0 \\ 6 & -2 \end{bmatrix} \quad v := \begin{bmatrix} -5886 \\ 1962 \\ 0 \end{bmatrix} \quad \text{Isolve}(M, v) = \begin{bmatrix} 654 \\ 1.962 \cdot 10^3 \end{bmatrix}$$

