Three-Dimensional Resultants

To resolve all forces and moments to one point (see Figure 2/28).

1. Replace all forces to a point O.

2. Compute vector moments associated with replacing those forces.

3. Sum forces and moments.

\[ \mathbf{R} = \mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3 + \ldots = \sum \mathbf{F} \]

\[ \mathbf{M} = \mathbf{M}_{O1} + \mathbf{M}_{O2} + \mathbf{M}_{O3} + \ldots = \sum (\mathbf{r} \times \mathbf{F}) \]

To produce a wrench resultant (see Figure 2/29).

4. Resolve the moment \( \mathbf{M} \) into components parallel (\( \mathbf{M}_1 \)) and perpendicular (\( \mathbf{M}_2 \)) to \( \mathbf{R} \).

5. Relocate \( \mathbf{R} \) through \( \mathbf{r} \) far enough to produce the perpendicular moment \( \mathbf{M}_2 \) by virtue of its new position.

See vector equations on the board.