Existing Methods

Muscle-only arm design

Task shape requirement

Task load requirement

Closest equilibrium shape

$p = \begin{bmatrix} 0 \\ 0 \\ 100 \\ 100 \end{bmatrix}$

$p = \begin{bmatrix} 0 \\ 0 \\ 30 \\ 80 \end{bmatrix}$

$p = \begin{bmatrix} 0 \\ 70 \end{bmatrix}$

$p = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$

Task **not attainable** by a muscle-only arm.

Antagonistic arm design

Task shape

Task load requirement

Closest equilibrium shape

$p = \begin{bmatrix} 80 \\ 0 \\ 100 \\ 0 \end{bmatrix}$

$p = \begin{bmatrix} 0 \\ 0 \\ 100 \\ 0 \end{bmatrix}$

$p = \begin{bmatrix} 30 \\ 0 \\ 100 \\ 0 \end{bmatrix}$

Task **almost attainable** by an antagonistic arm.

Our Method

A

Bellows-only

Antagonist

Requirements from lip-loads

s [unitless]

Internal force [N]

Internal moment [Nm]

B

Count

Absolute attainability