Optimal design of a four bar mechanism for forestry robotic applications

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In many countries, forestry machines are the primary industrial tool to extract wood out of forests.

The scientific and technological development to improve forestry machines has increased over the past years.
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Introduction

Design Methods

Conventional Design Method

Optimal Design Method
In general, an optimization problem can be stated as follows:

\[
\min_{\chi} \bar{J}_i(X, t), \quad i = 1, \ldots, n
\]  

(1)

subject to:

\[
\dot{x} = \frac{dx}{dt} = f(x, t)
\]

\[
g_{d_j}(X, t) < 0, \quad j = 1, \ldots, n_{gd}
\]

\[
h_{d_k}(X, t) = 0, \quad k = 1, \ldots, n_{hd}
\]  

(2)
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Factors to take into account:

- The maximum and minimum desired range of motion such that the joint achieves its maximum range when the cylinder's stroke is fully extended and vice versa.
- How we intend to place the cylinder in the crane.
- How to achieve these goals using the minimum amount of components.
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Optimal design of a four bar mechanism

Min \[(D_{ip} - R_{ip})^2 + (D_{fp} - R_{fp})^2\] (3)

subject to:

\[g_{sj}(X) < 0, \quad j = 1, \ldots, n_{gs}\]
\[h_{sk}(X) = 0, \quad k = 1, \ldots, n_{hs}\] (4)
Thank you!