Reducing Structural Error in Function Generating Mechanisms via the Addition of Large Numbers of Double-Crank Linkages

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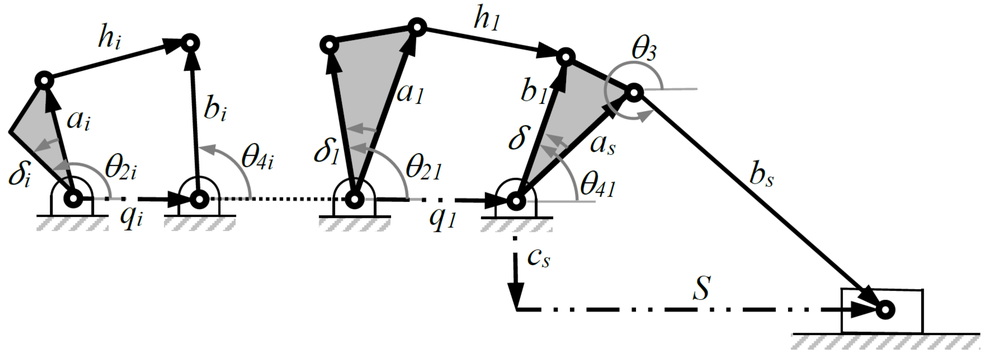
Objective: This research presents a methodology for synthesizing planar linkages to approximate any prescribed periodic function.

Introduction:

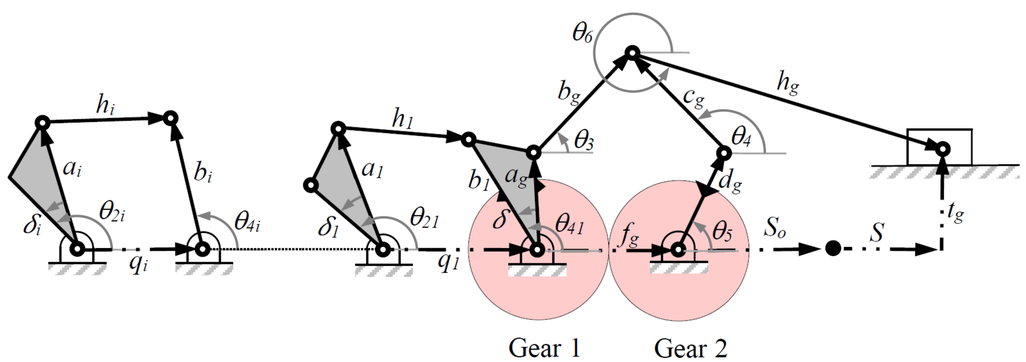
The three planar mechanisms selected for this research are the slider-crank and the geared five-bar with connecting rod and sliding output (GFBS), where any number of drag-link (or double crank) four-bars are used as drivers

For single maximum periodic functions, the following chain is used



The chain of drag-link mechanisms added to a terminal slider-crank mechanism.

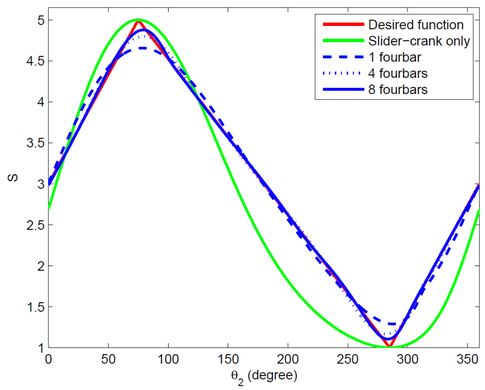
For multiple maxima periodic functions, the following chain is used



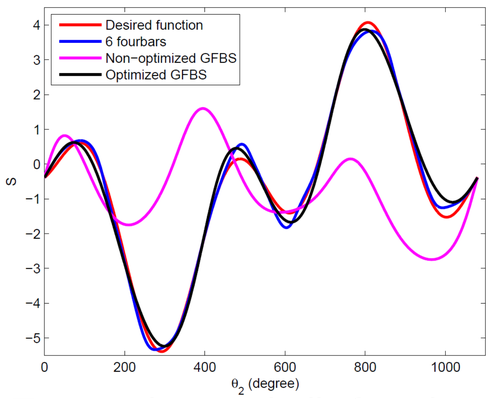
The chain of drag-link mechanisms added to a GFBS.

Examples:

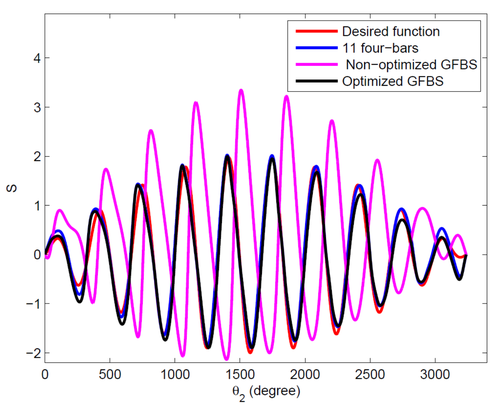
A piecewise-linear periodic function



Three maxima periodic function



Ten maxima periodic function



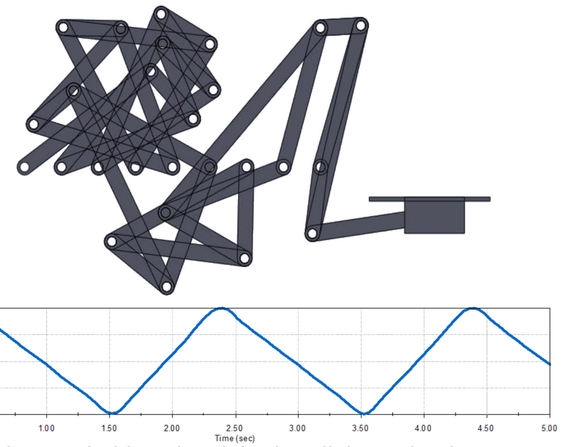
Motivation:

Without constraining the complexity (e.g. number of links) of 1 DOF devices, how accurately can we produce arbitrary periodic curves?

Methodology:

- Develop design equations for the three mechanisms utilized.
- Apply local random search optimization technique.
- Utilize MATLAB to run the optimization .

Verification of the Results:



A slider-crank driven by eight drag-link mechanisms

Conclusions:

- Structural error is decreased as drag-link mechanism is added as a driver.
- The synthesized mechanisms are allowed to be of any number of links.