Parallel Computation for Complex Linkage Design

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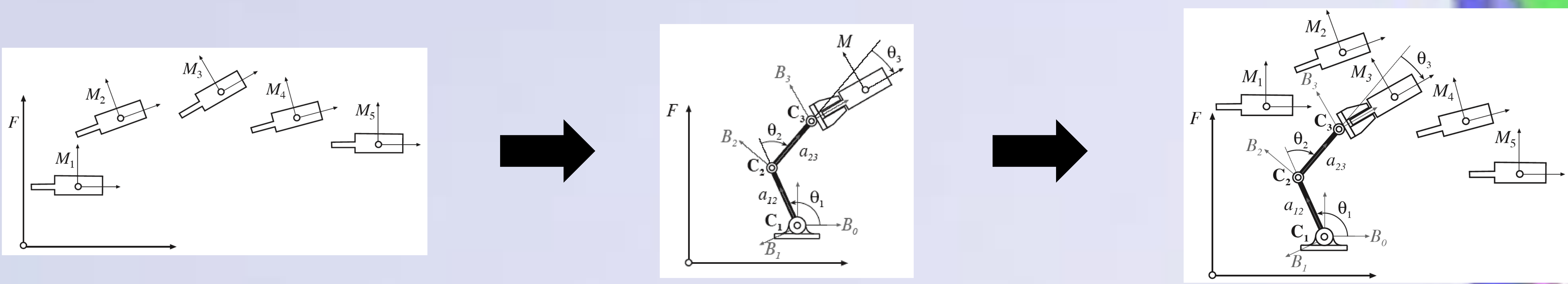
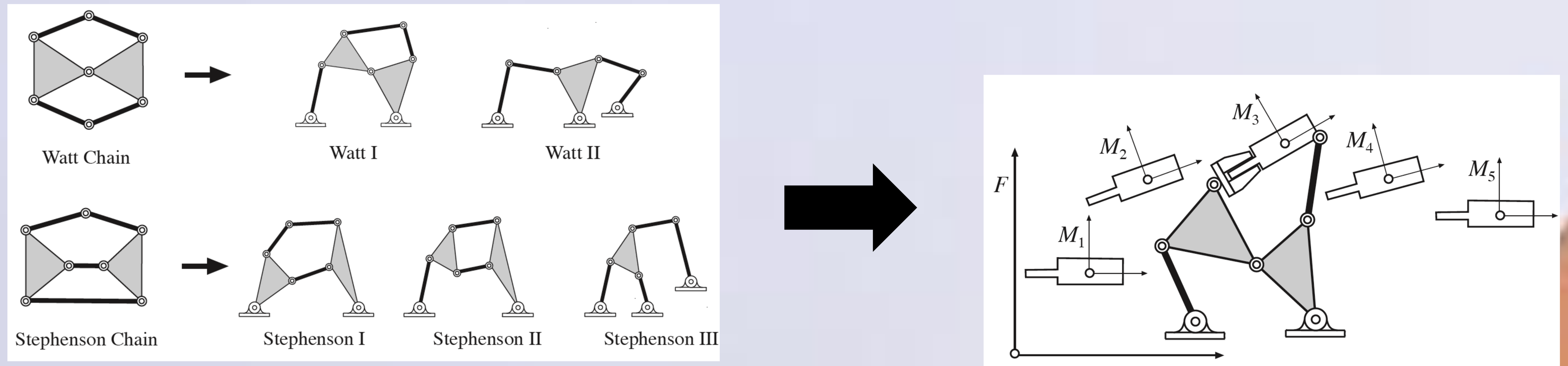
Kinematic Synthesis*

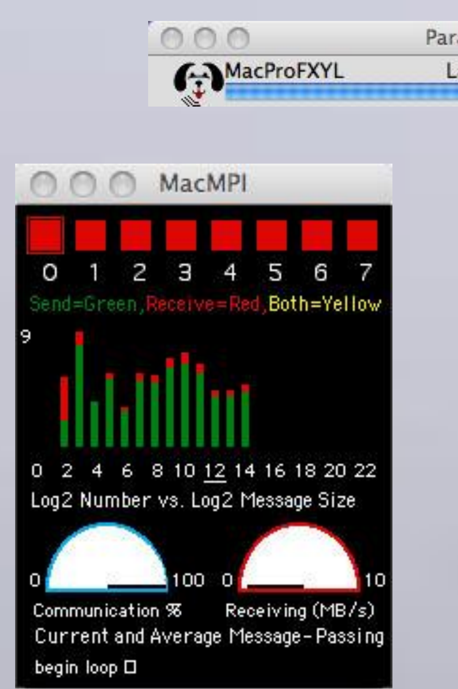


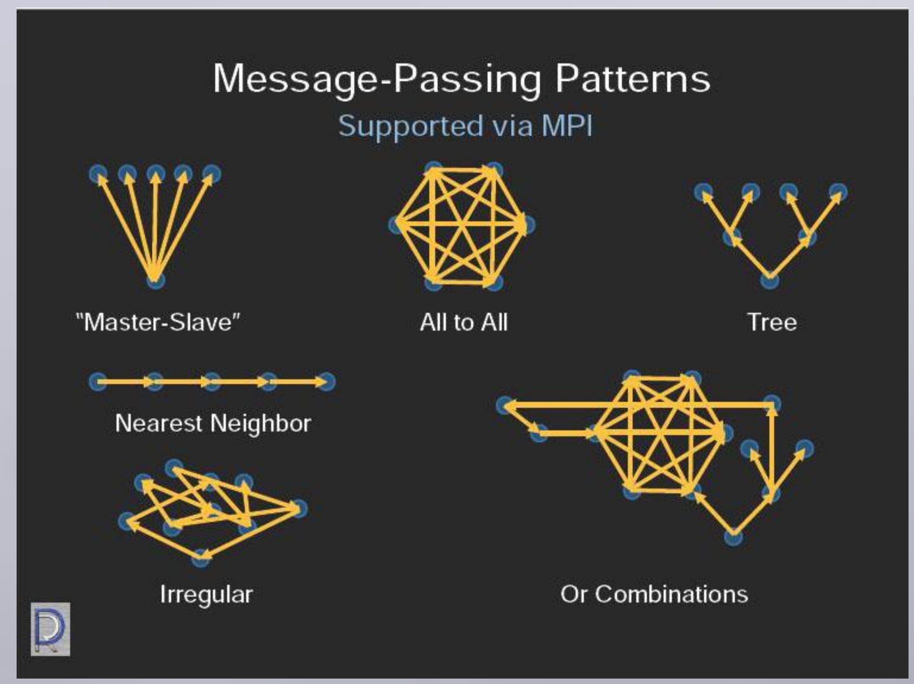
Given a set of task positions, our goal is to design a six-bar linkage that passes smoothly through all of the positions. Smoothly, means that the linkage remains in one assembly mode, so the linkage does not have to be disassembled to reach the various position.



Once a 3R planar chain has been specified that reaches a set of goal positions, we can “program” its movement using mechanical constraints. The resulting mechanism moves with one degree of freedom.

Parallel Computation

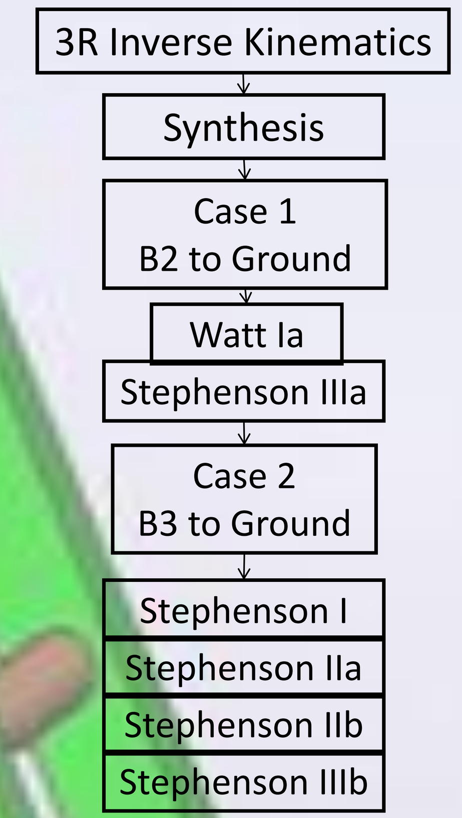


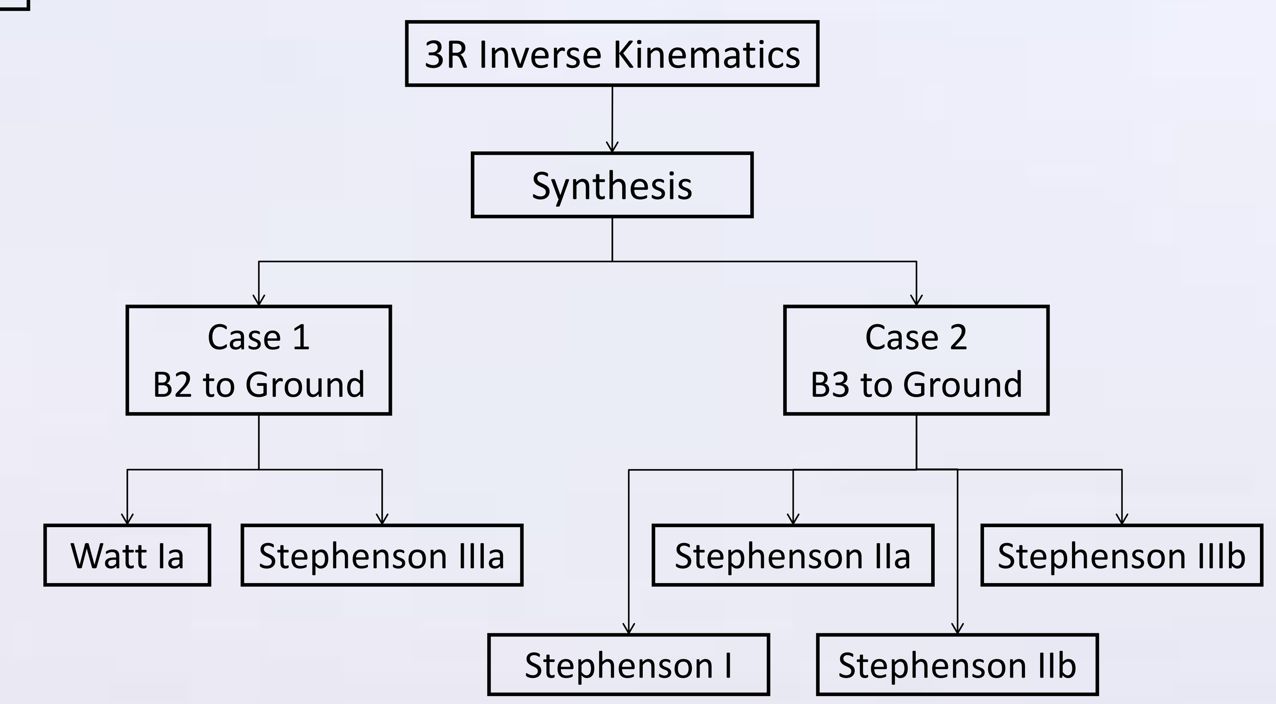


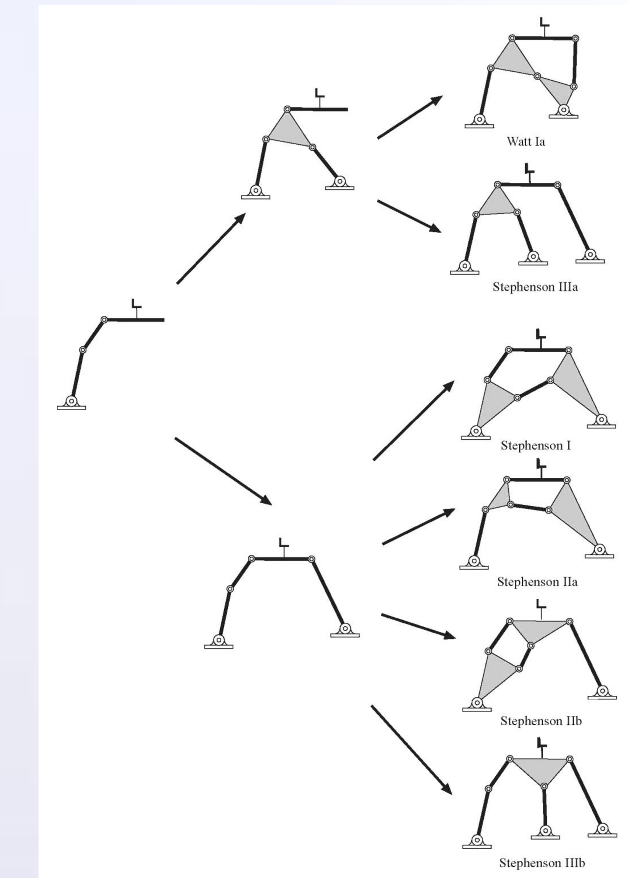
Supercomputing Engine for Mathematica (SEM) interface, message-passing options and Mac servers.

*G. S. Soh and J. M. McCarthy, 2008, “The Synthesis of six-bar linkages as constrained planar 3R chains.” Mechanism and Machine Theory 43; 160-170.

Approach

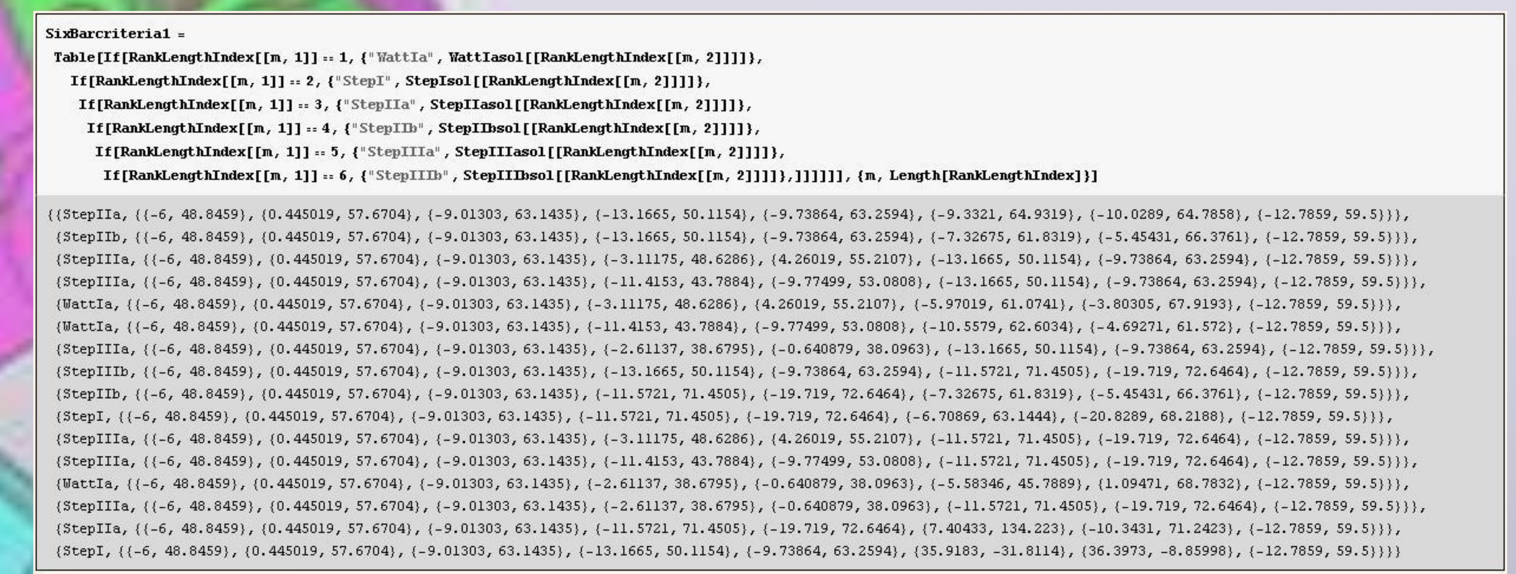






Our approach involved beginning with 3R planar chain synthesis. Our first approach involved using parallel computation for all of our calculations but maintaining series execution of the cases. Our second approach involved dividing the cases by dependency and assigning a processor to each case.

Results



The results obtained were for the synthesis of each iteration of a six-bar linkage only.
Previous work on a single processor: 8.35 seconds
First approach: 107.83 seconds
Second approach: 5.72 seconds

We expect parallel computation with our second approach to greatly improve computational time of synthesis plus analysis and animation of each six-bar linkage.

Acknowledgements

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