

The Application of Four Bar Linkages in a Passive Robotic Balancing Mechanism

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Research Question

Can a series of four-bar linkages be applied to create a passive balancing mechanism?

Conceptual Design

The conceptual design that I have settled on to attempt to create a balancing robot utilizes two moment resisting “feet”, a four-bar linkage attached to the feet, a reverse four-bar linkage stacked on top of the four-bar linkage, and a mass to act as counterbalance for the system.

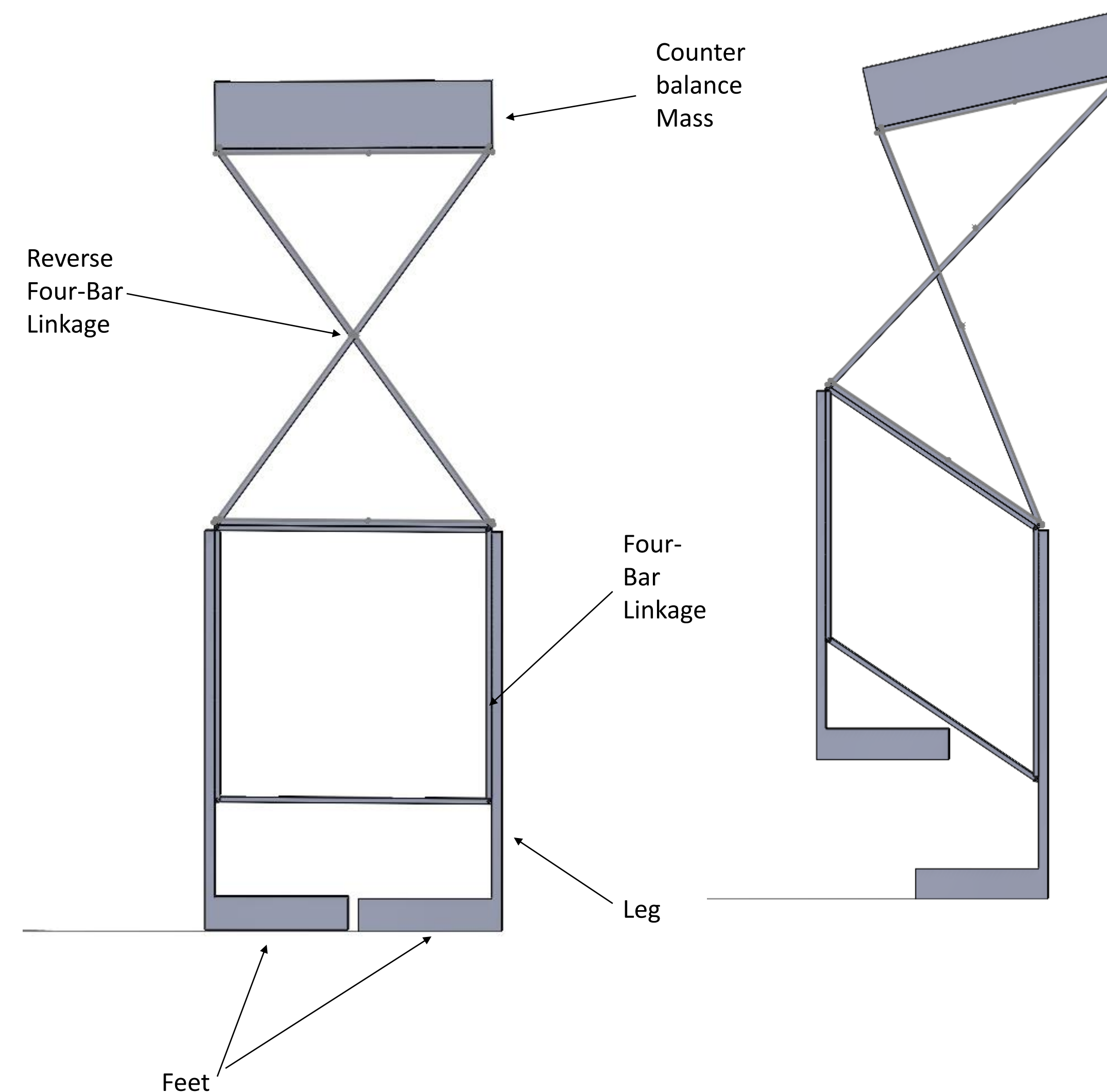
Methods

I have created a CAD model to prove the system could function kinematically, this model is currently being adjusted to find the ideal bar length to allow for balancing of the mechanism.

We are continuing to evaluate what graphical simulation tool would allow us to iterate our designs while mimicking reality. Work is ongoing to find a tool which is both easy to use and stable.

The current approach I will be taking involves Mathcad to solve a series of center of gravity equations iteratively to find the ideal mass and dimensions required of each of the four bar systems.

$$x_{effective} = \frac{m_1 \cdot x_1 + m_2 \cdot x_2 + m_3 \cdot x_3}{\Sigma m}$$



Future Work

Our process involves 1) selecting a mechanism where the mass can be moved as a function of its configuration 2) identifying the center of gravity of the mechanism as a function of its configuration 3) evaluating the mechanism in a simulation 4) constructing a real-world prototype 5) evaluation its ability to maintain its center of mass with the width of the mechanisms “foot” 6) iterating on this design to increase the reliability of this mechanism

