

Computational Design + Fabrication: 4D Design

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September 30, 2015

- News
- 4D Basics
- 4D Examples
- 4D Kinematics
- Paper Review ***



- lab 3 due thursday
- section tomorrow 2-3p in soda 373
- jacobs 3d printer training

<https://bcourses.berkeley.edu/courses/1353091>

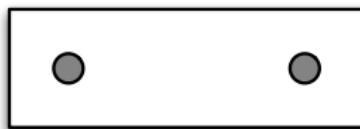
- articulated shapes
- linkages



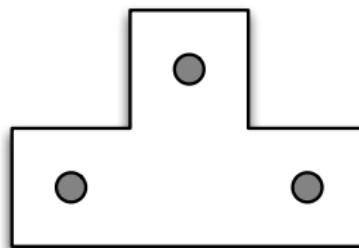
source HumongoNationphotogallery

- change motion
- amplify force

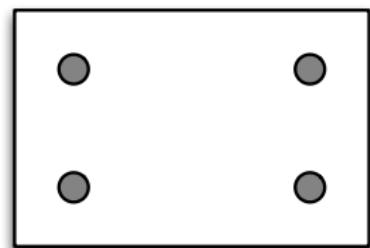
- link: solid shape
- node: attachment point
- number of nodes
- examples – binary, ternary, quaternary



binary

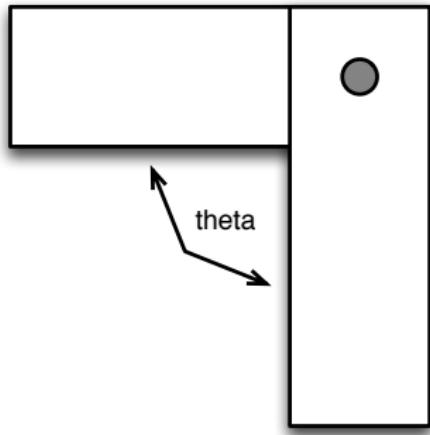


ternary

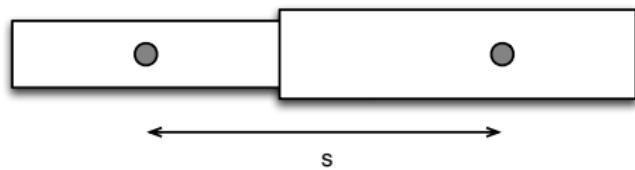


quaternary

- constrained motion around point
- single degree of freedom

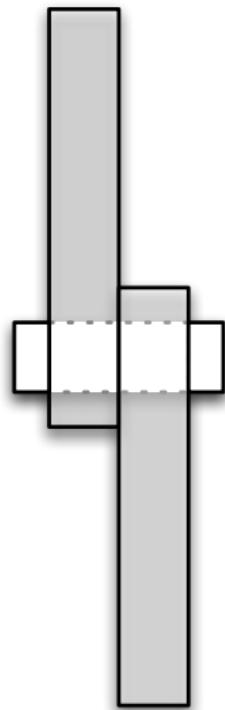


revolute

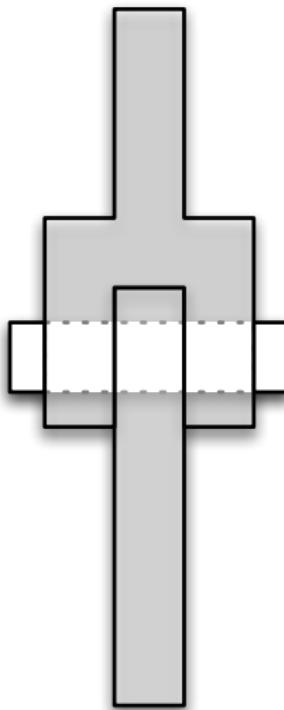


prismatic

Revolute Implementations

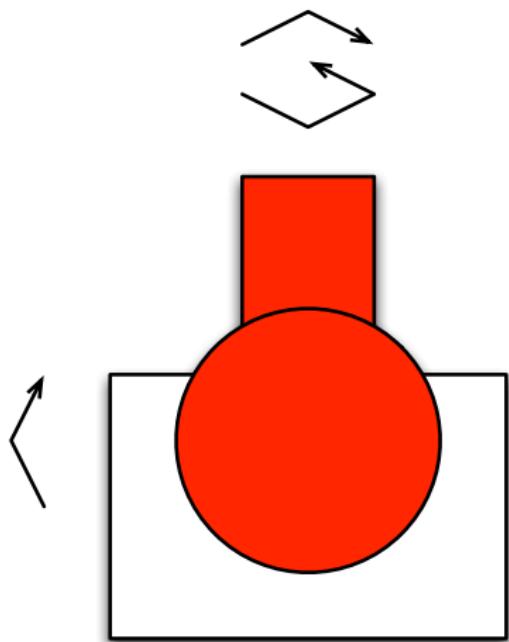


cantelever

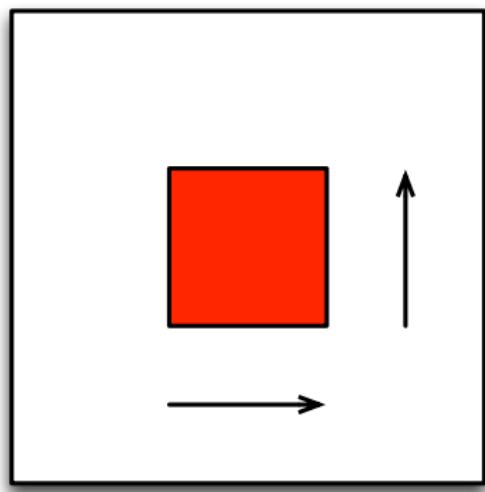


clevis

Multiple DOF Joins

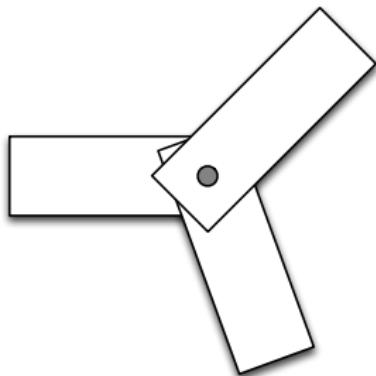


universal

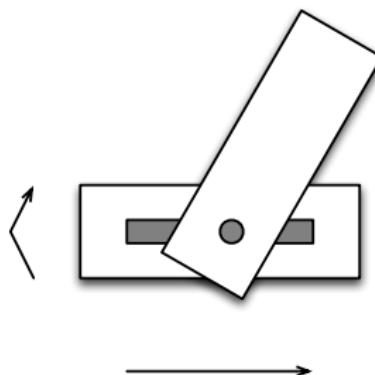


planar

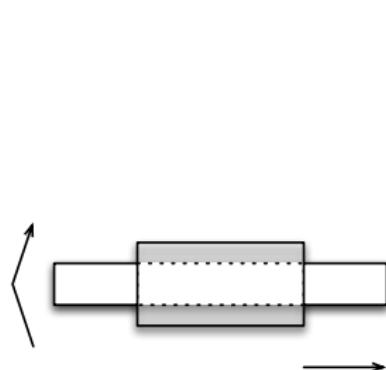
- multiple revolute joints
- prismatic + revolute joints



second-order-pin-joint



pin-in-slot



RP

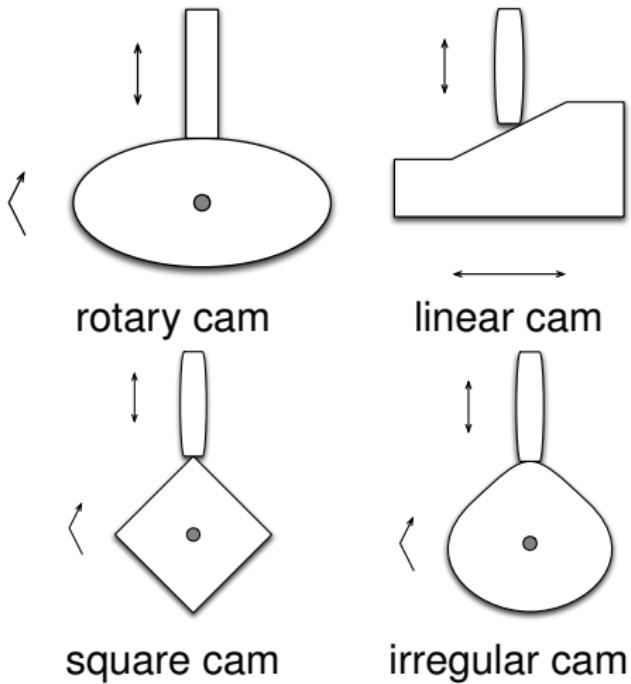
Two Revolute Universal

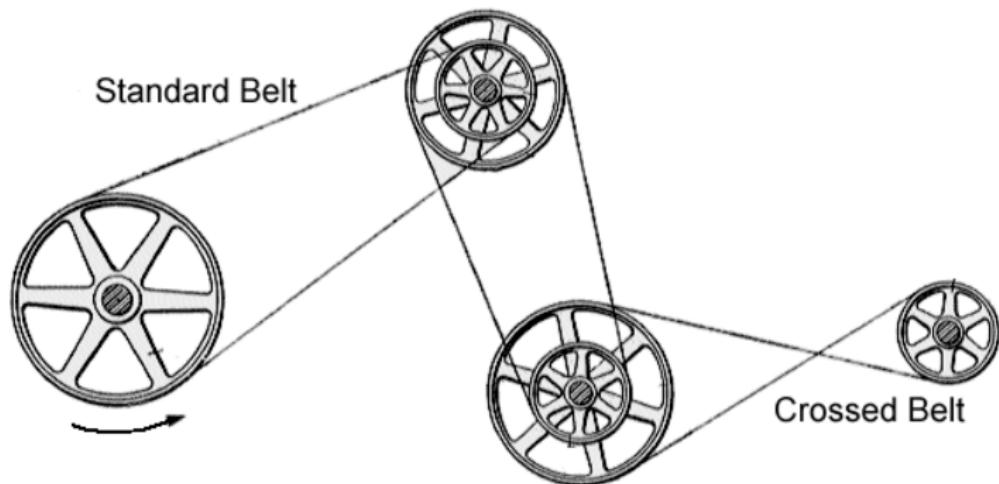
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- mechanical computers
- how do you program them?
- start with predicting outcomes
- look at some examples
- talk about the programming problem next week

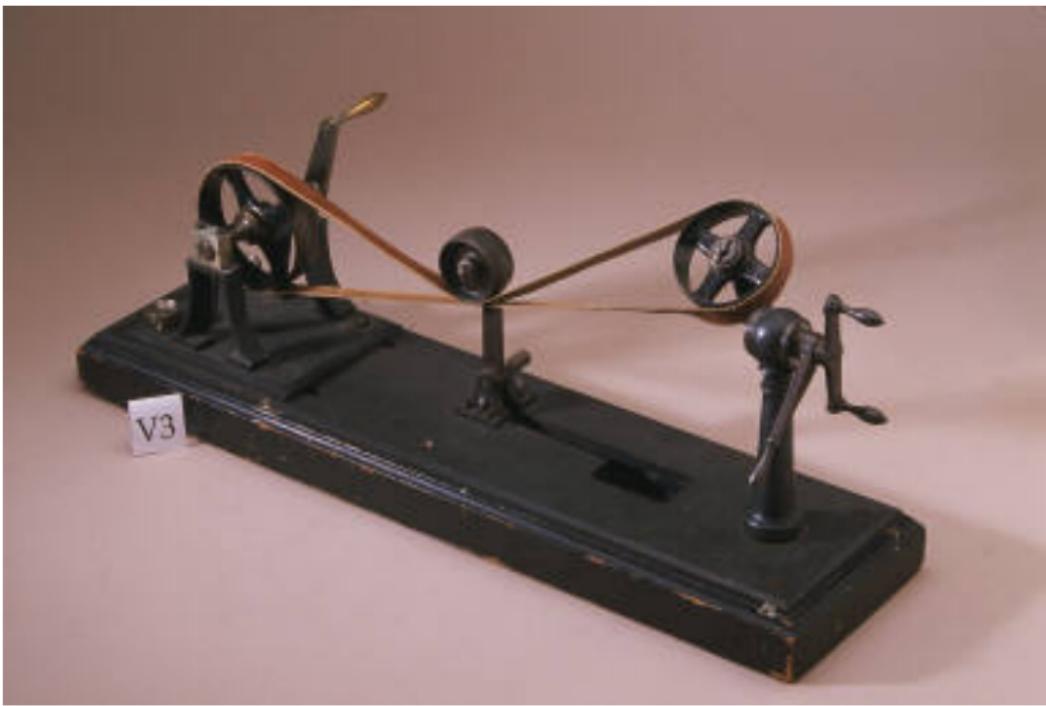
- rudiments
- machinery
- automotive
- artistic
- robotics





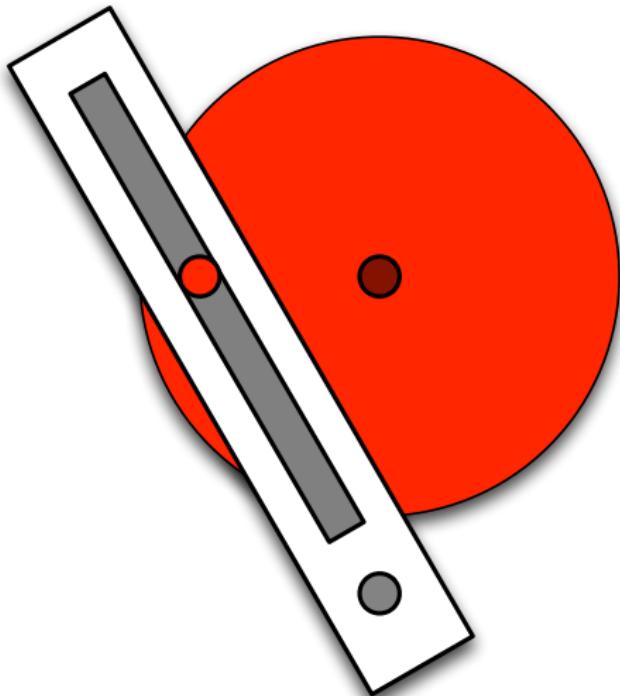
Direction Changing Pulley

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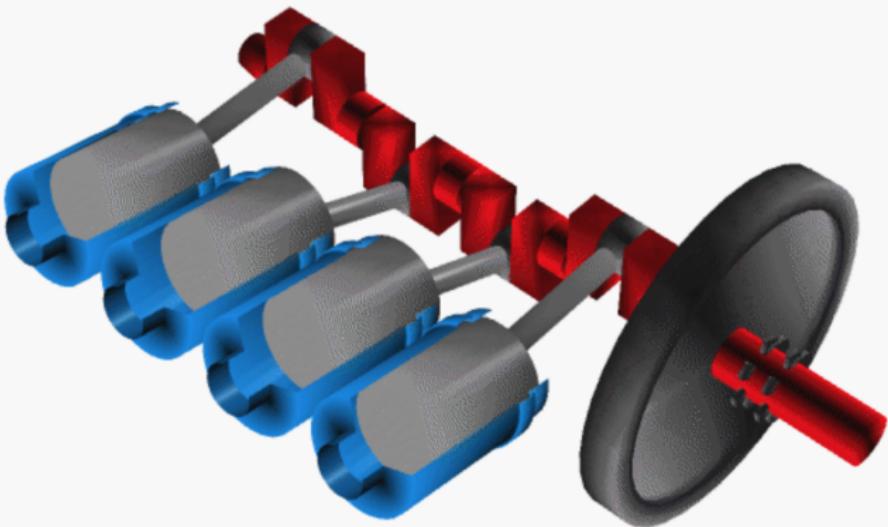


Quick Return

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Crank and Slider



Line Drawing

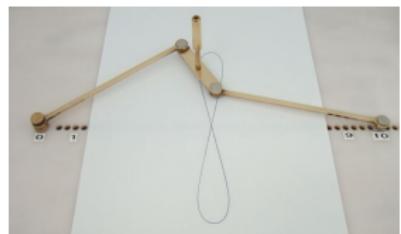
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roberts



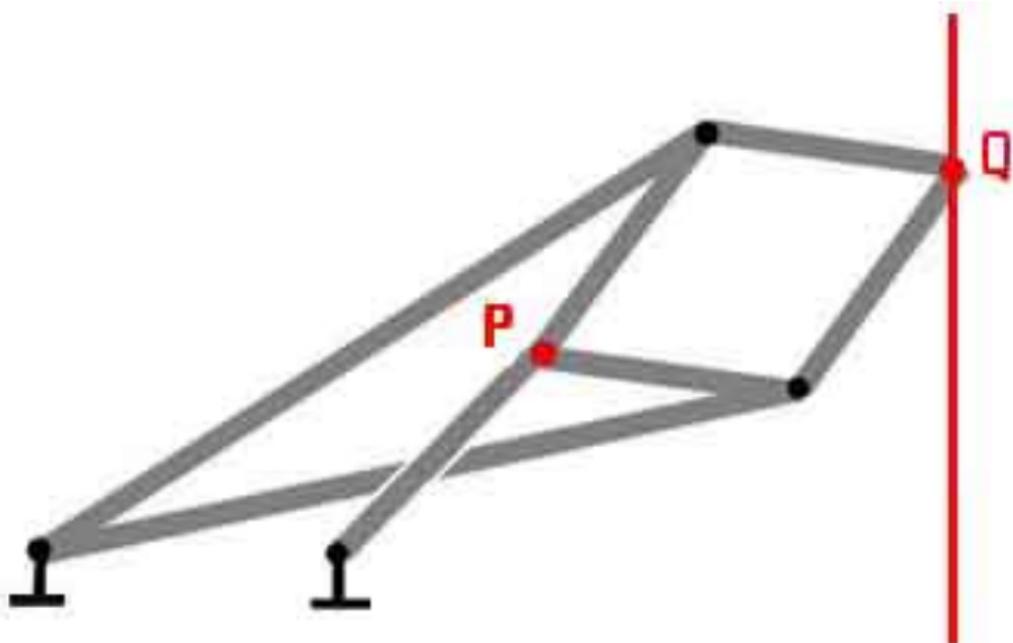
chebyshev



watts

Peaucellier-Lipkin Linkage

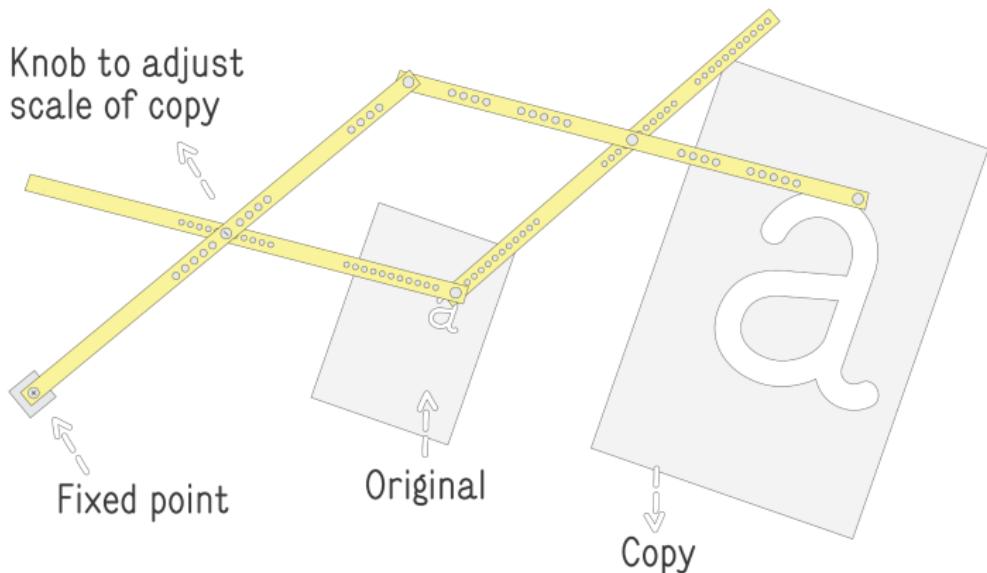
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Vice Grips

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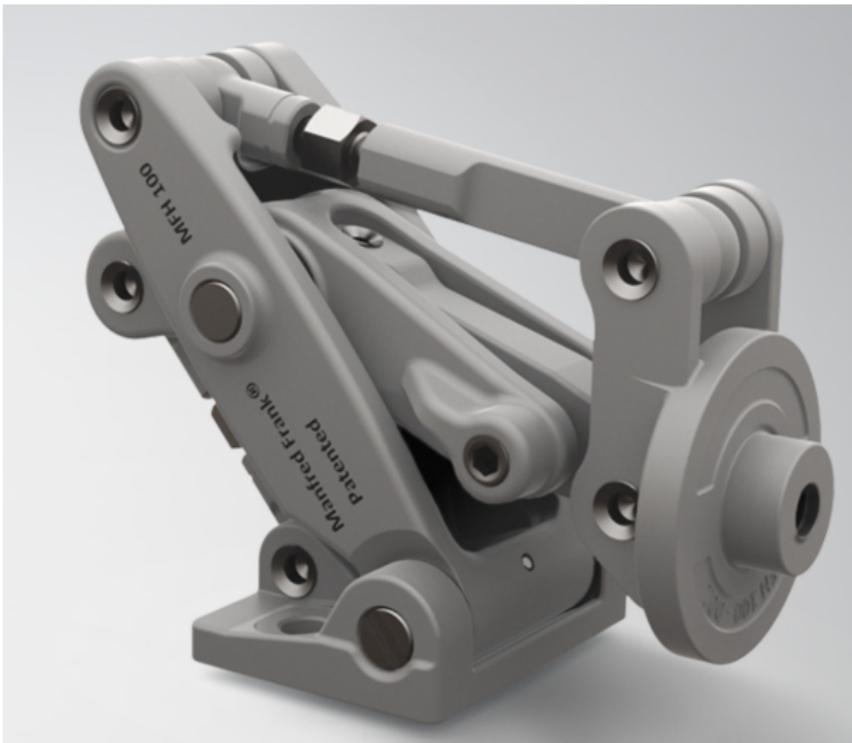




Scissor Mechanism

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by Manfred Frank



Mountain Bike Shock Absorber

25



source bikerumor.com

Small Back Hoe

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Back Hoe

27



Specialty Back Hoe

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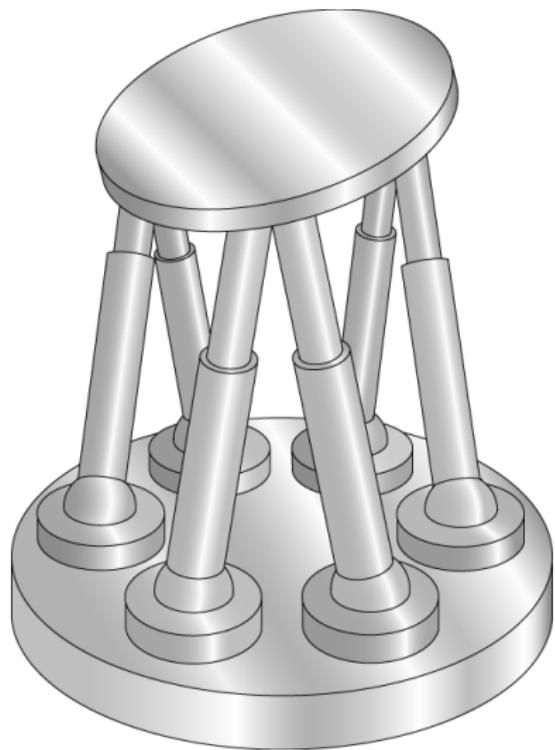
Front Loader

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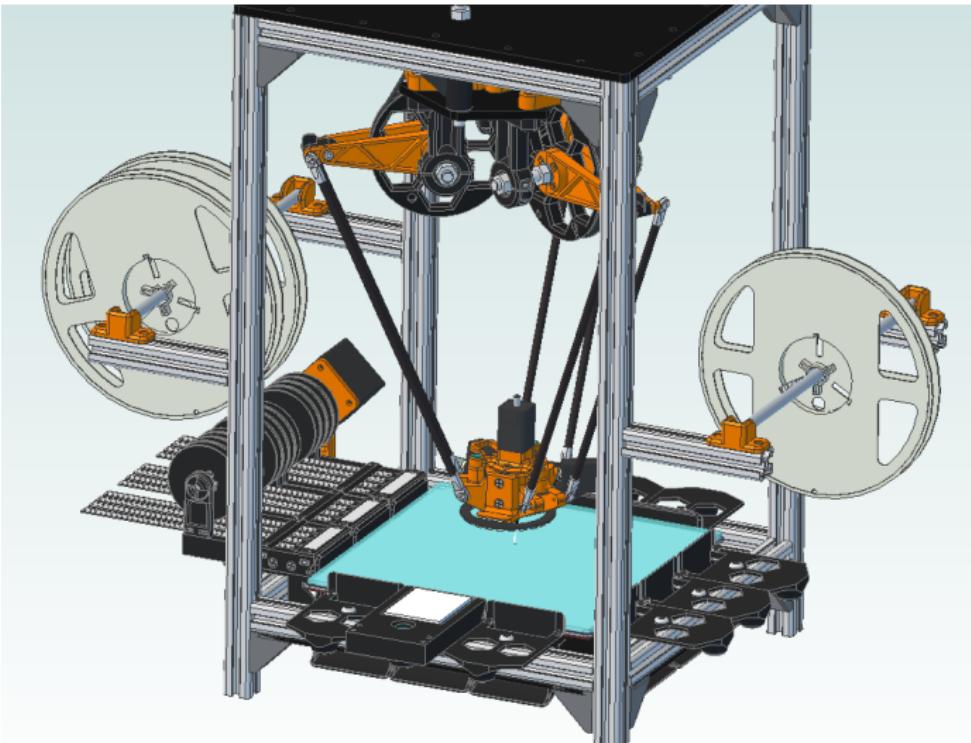
Stewart Platform

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Delta Mechanism

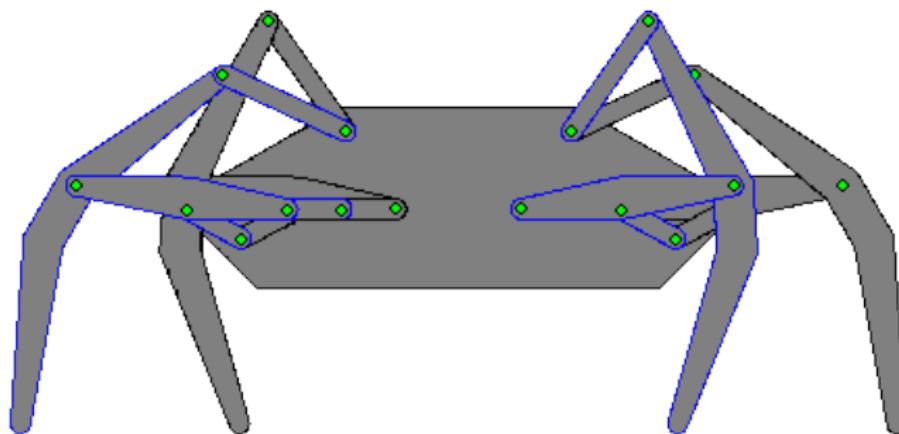
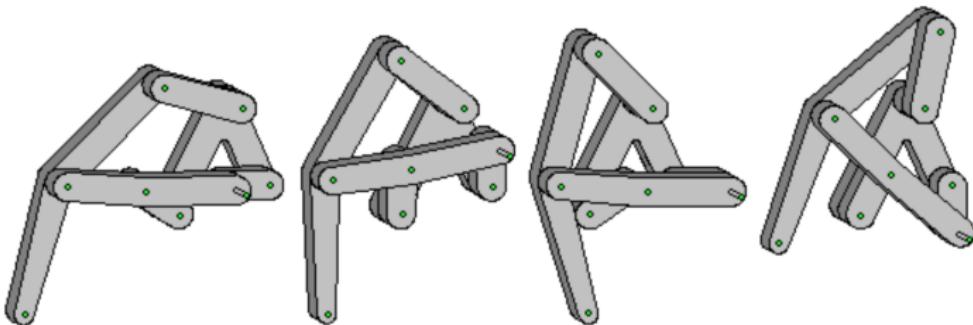
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by Firepick

Klann Linkage

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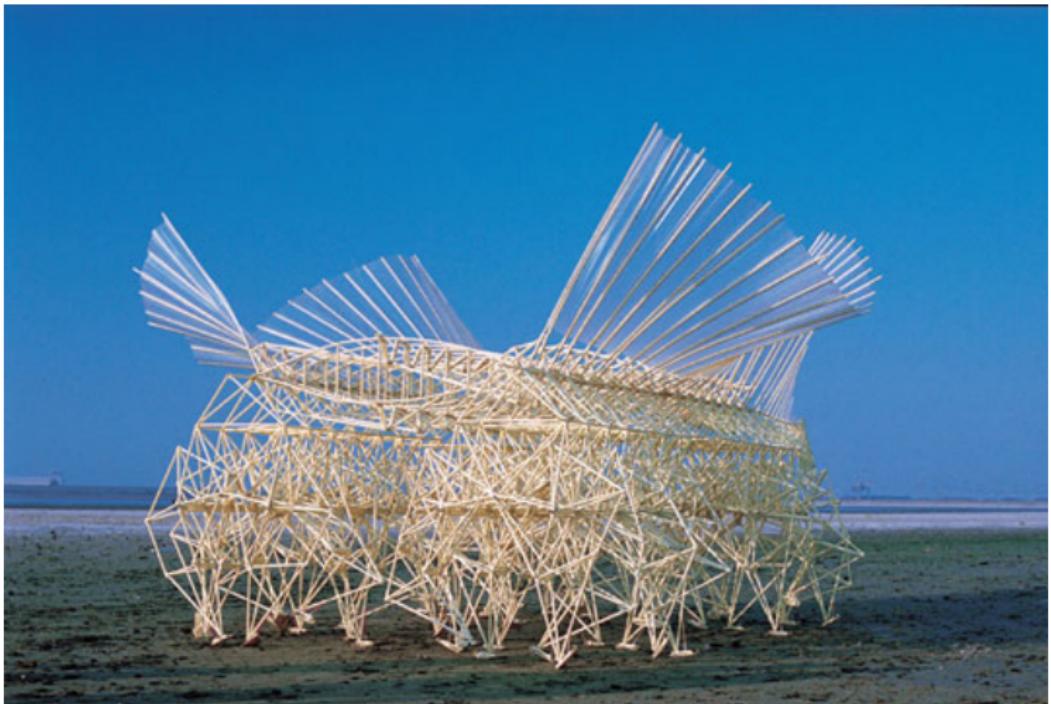
Strandbeest by Theo Jansen

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Strandbeest by Theo Jansen on Beach

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<https://www.youtube.com/watch?v=MYGJ9jrbpvg> standbeest evolution theonjansen

<https://www.youtube.com/watch?v=HLkd1xXrie0> theojansen mechanisms in solidworks

- forward kinematics go from joint parameters to positions
- inverse kinematics go from positions to joint parameters

- 4D Work and Torque
- 4D Closed Chains
- 3D Critique

- *Design FUNdaMENTALS: Linkages* by Alexander Slocum
- *507 Mechanical Movements: Mechanisms and Devices* by Henry T. Brown