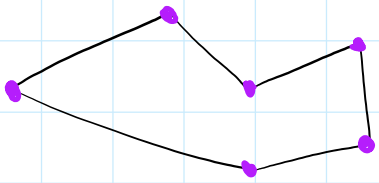
CLOSED POLYGONAL CHAINS

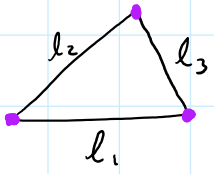


Rigid segments, connected by joints that allow rotation.
(Length of each segment is fixed.)

Without loss of generality, regard one edge as fixed.

n=3 edges:

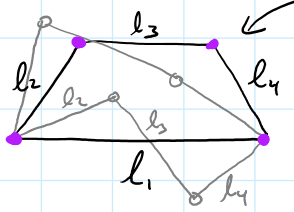
lengths: ℓ_1, ℓ_2, ℓ_3



No deformation is possible.
Configuration space: one point.

n=4 edges:

lengths: $\ell_1, \ell_2, \ell_3, \ell_4$

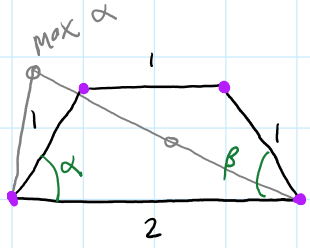


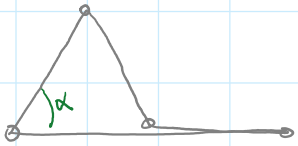
4-bar linkage

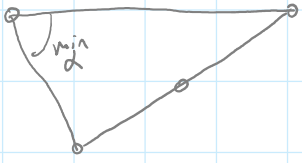
What is the configuration space?

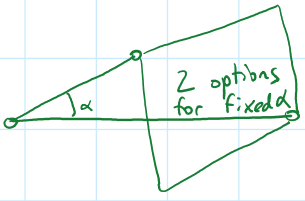
EXAMPLE:

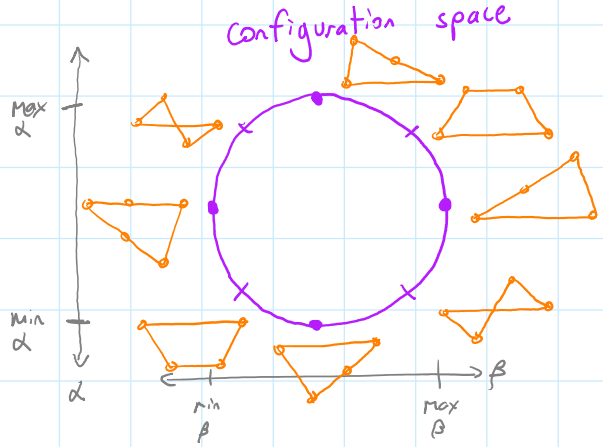
lengths: 2, 1, 1, 1





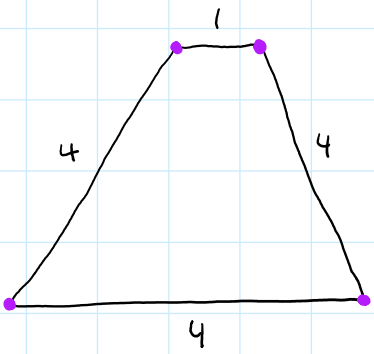


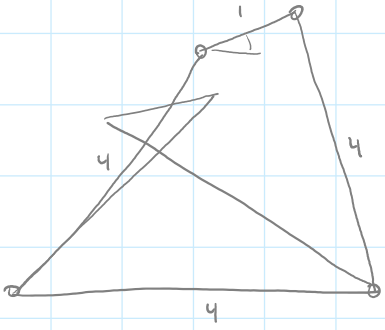




EXAMPLE:

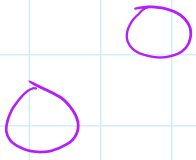
lengths: 4, 4, 4, 1





Configuration space:

2 loops



Interactive Demo: http://dynref.engr.illinois.edu/aml.html

APPLICATION: Watt's Linkage

VIDEOS: https://youtu.be/bsRmE5AU9x0 https://youtu.be/aPzDGXXbwKQ