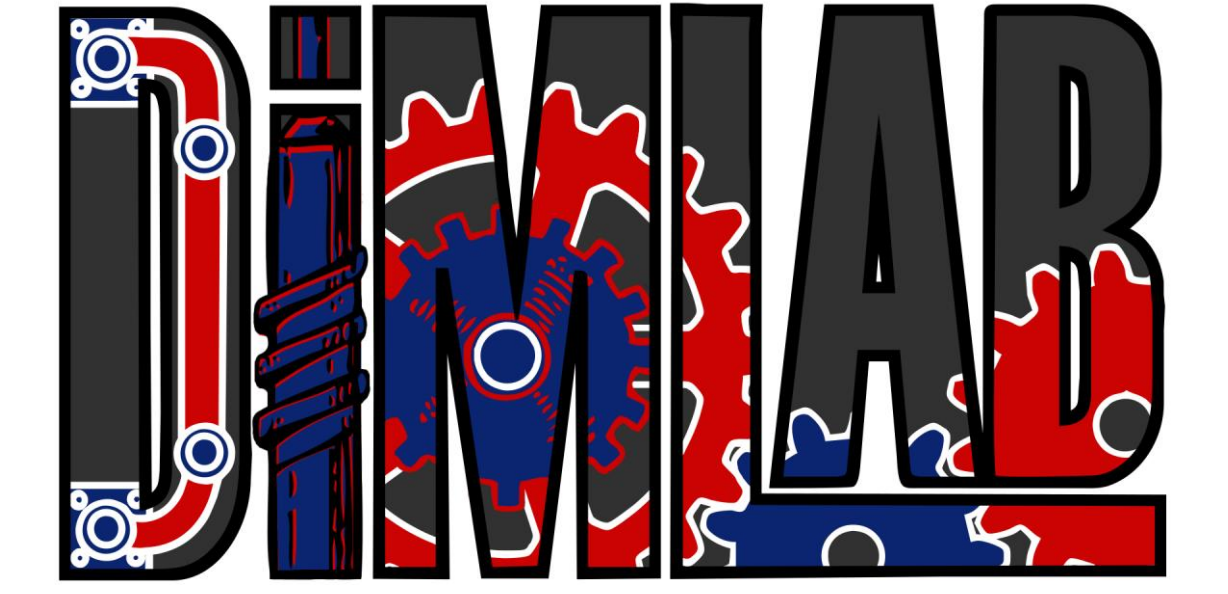


Design Modeling of Spatial Shape-Change Linkages

Chengwei Shi

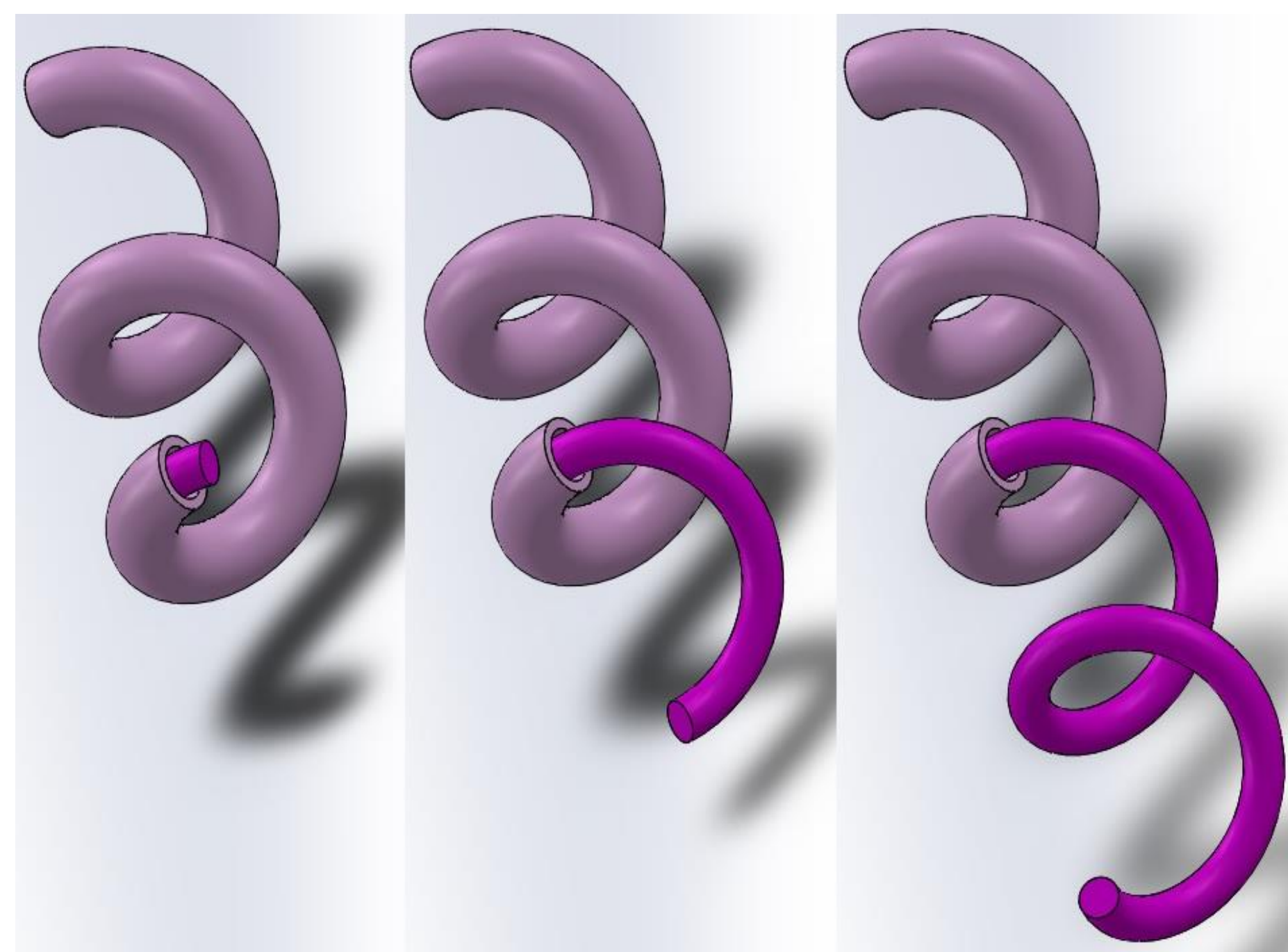
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Research objectives: The goal of this research is to develop mechanical designs of spatial shape-changing linkages. Mechanical systems often benefit from the capacity to vary between specific shapes in a controlled manner, such as a morphing aircraft wing that can adapt to different in-flight requirements. Spatial shape-changing linkages consist of a chain of three-dimensional bodies connected with ball joints. When the chain segments are repositioned, they match a set of arbitrary spatial curves. The research project involves creating the mechanical designs of the segments and motion control schemes that move the chain from the origin position to the target position. Animations are created in SolidWorks that demonstrate various motion schemes and illustrate the chain's approximation to the target spatial curves.

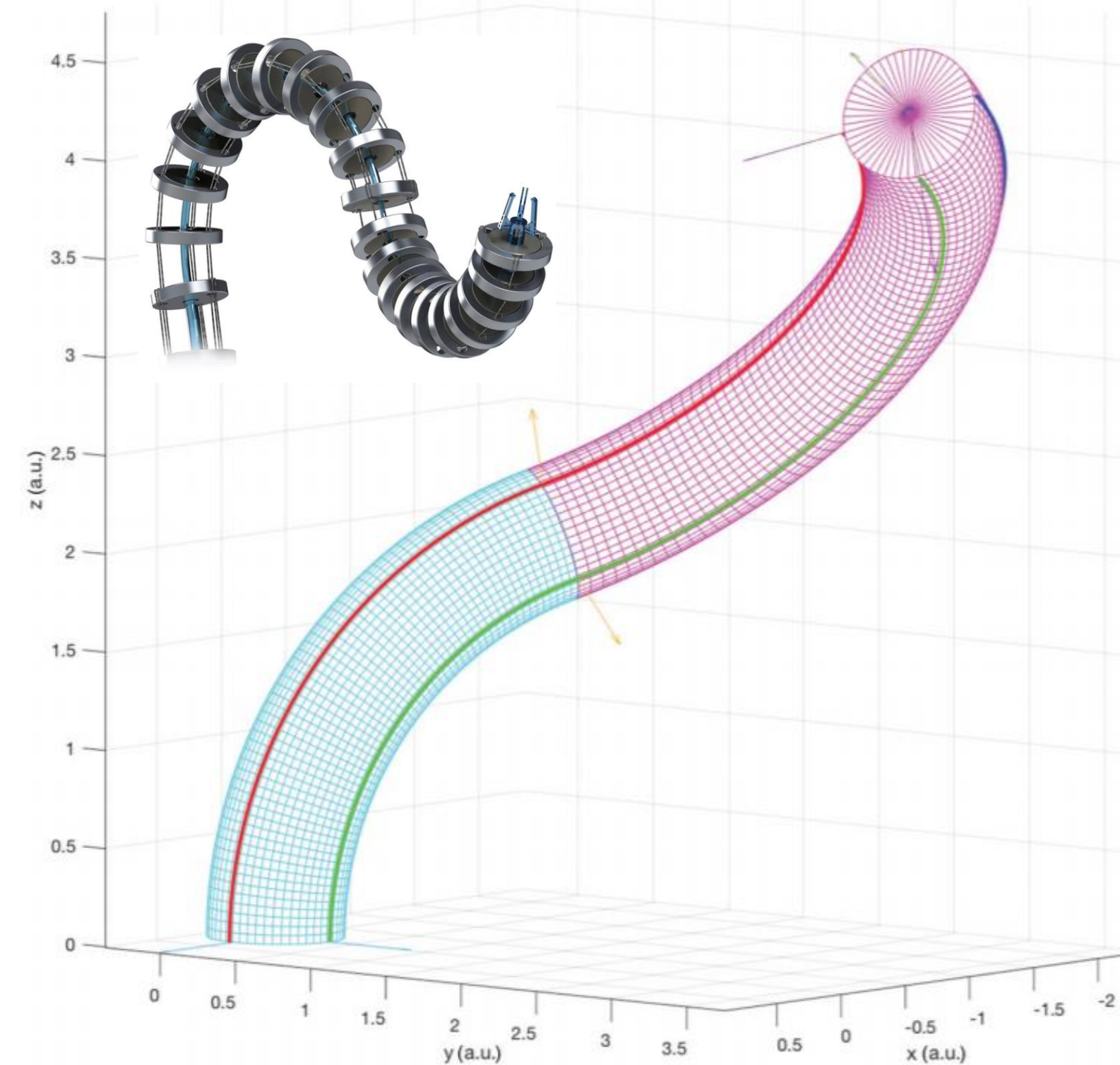
Helical (H) Segments

Constant curvature and torsion but varying length



Where are Spatial Shape-Changing Linkages Used?

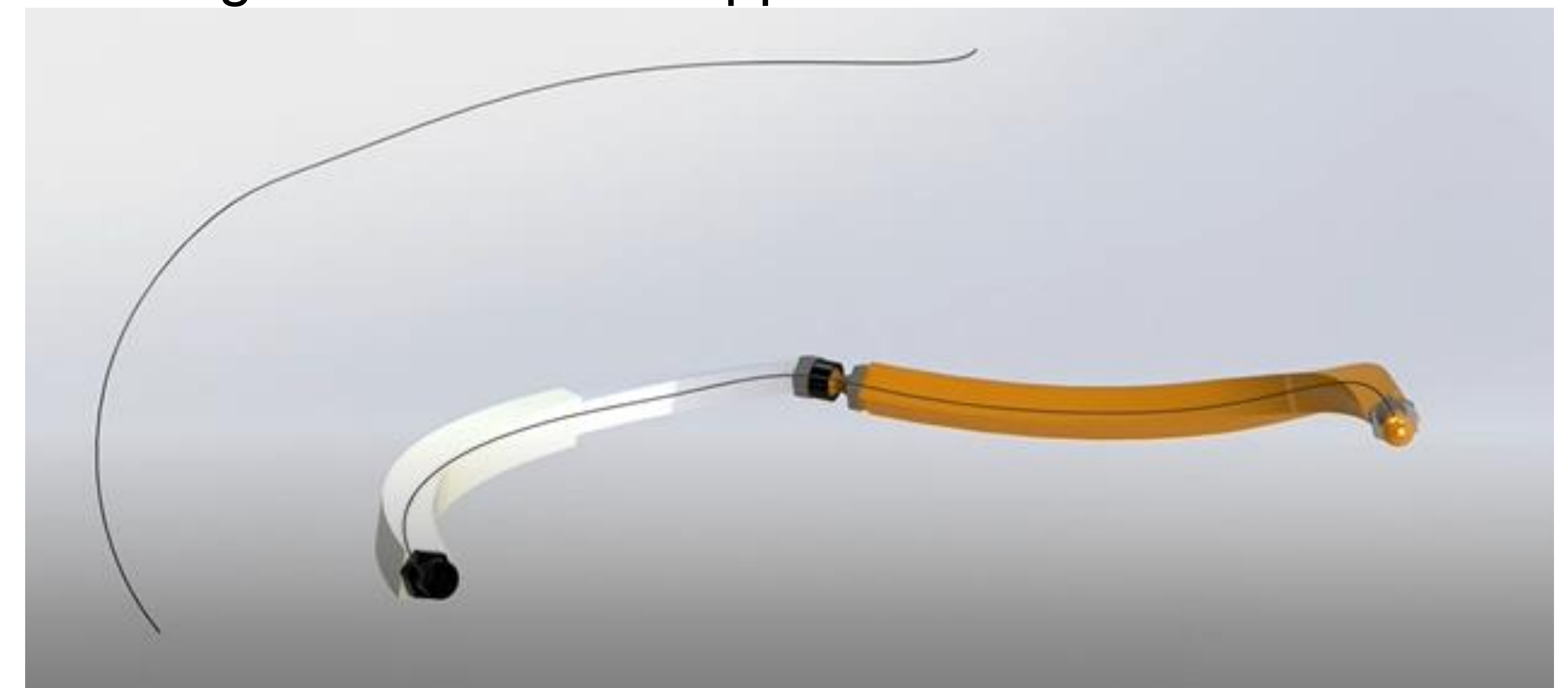
Continuum Robots



A Two Segment HM Chain

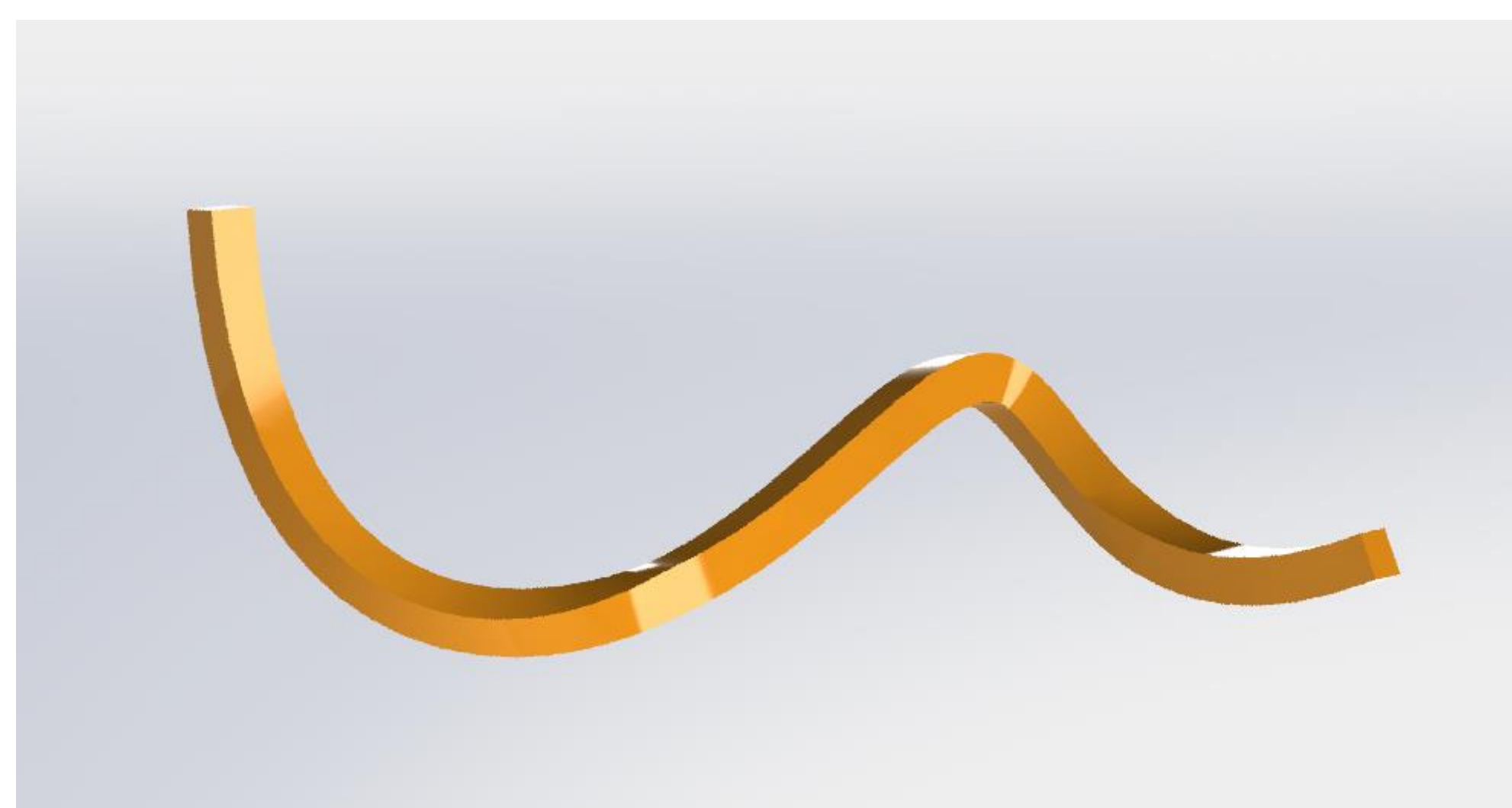


This two segment chain can approximate the two curves shown.

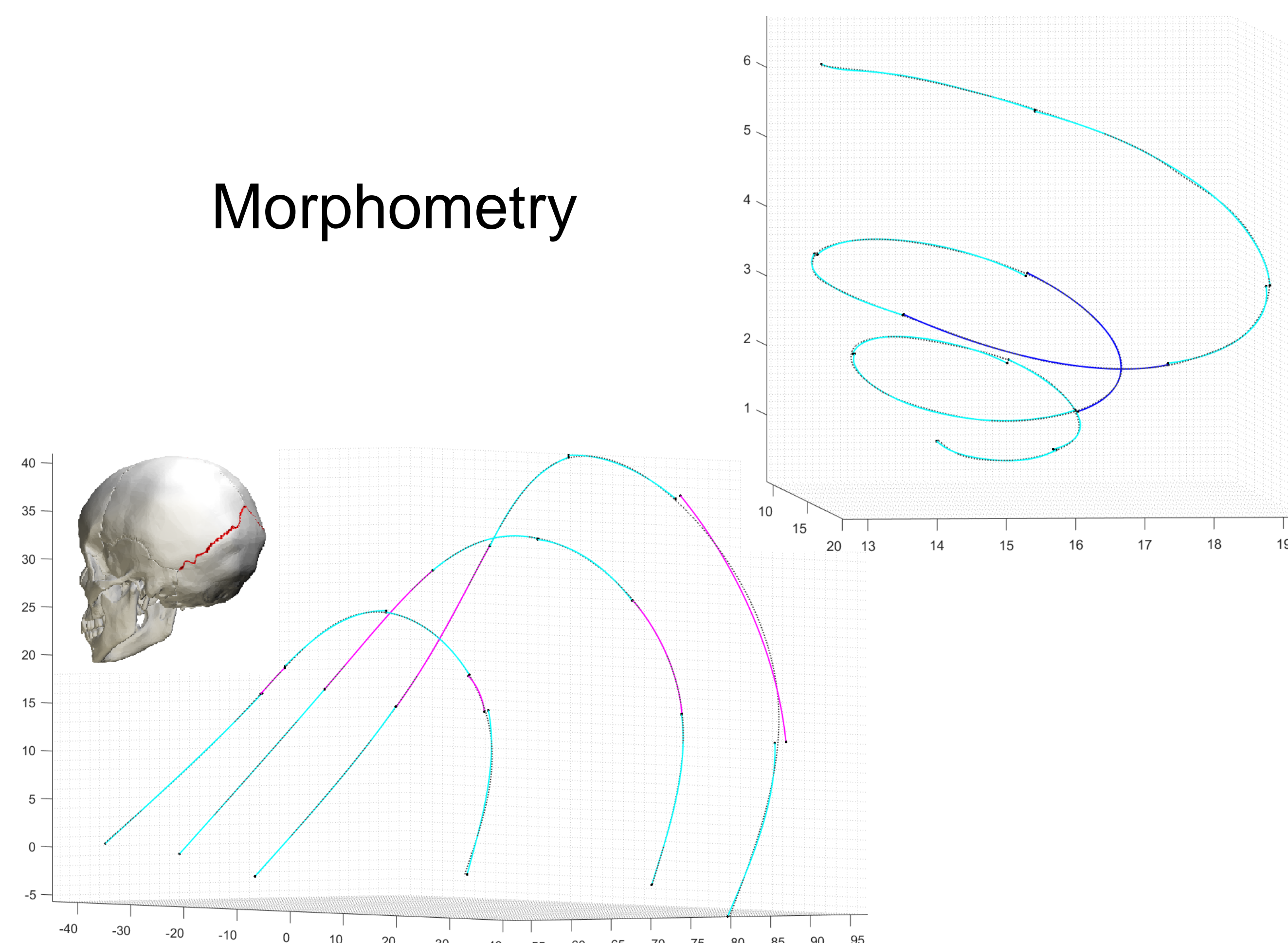


Rigid (M) Segments

Any spatial curve embodied as a rigid part



Morphometry



A Three Segment MHM Chain

