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Advancing Segmentation Techniques for Rigid-Body Shape-Changing Mechanism Design Specific to Variable Geometry Extrusion Dies

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**Research objectives:** To improve the kinematic theory for designing shape-changing dies or other rigid-body mechanisms which primarily use prismatic joints and require large differences in arc length between the desired profiles.

**Polymer extrusion**
Extrusion is the process of utilizing pressure to force melted plastic through die orifice. The channel shape of the die is what primarily defines the cross section profile of the extruded product. Shape-changing dies allow the cross section of the extrudate to alter during extrusion.

**Design methodology**
- Specify link types and joint types
- Create links
- Fuse links and close the chain
- Optimize the chain according to error matrix
- Shift end point position for closed profiles

**Rigid-body shape-changing mechanisms**
A typical shape-change problem seeks a device that approximates a set of specified shapes with the edge geometries of some of its components. Rigid-body mechanisms are able to create large changes in motion with readily predictable responses to a large variety of loading schemes.

**Shape-changing extrusion dies**
Revolute joints may introduce polymer leak, therefore it is desired to eliminate the use of revolute joints. Prismatic joints allow to achieve significant change in arc length of the profiles without causing leak.

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