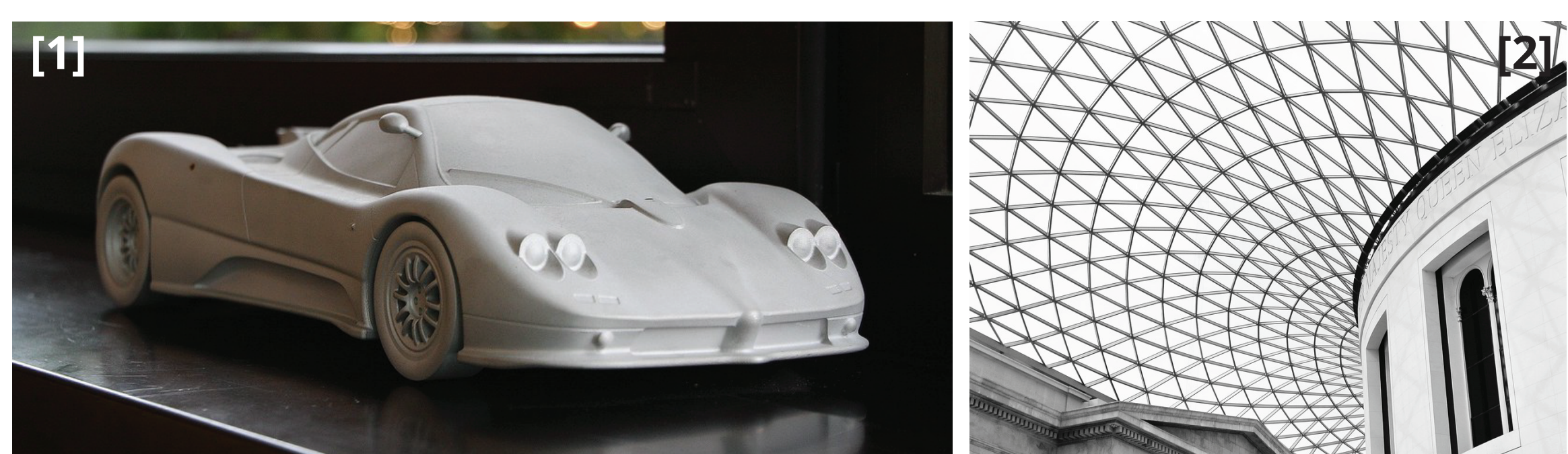
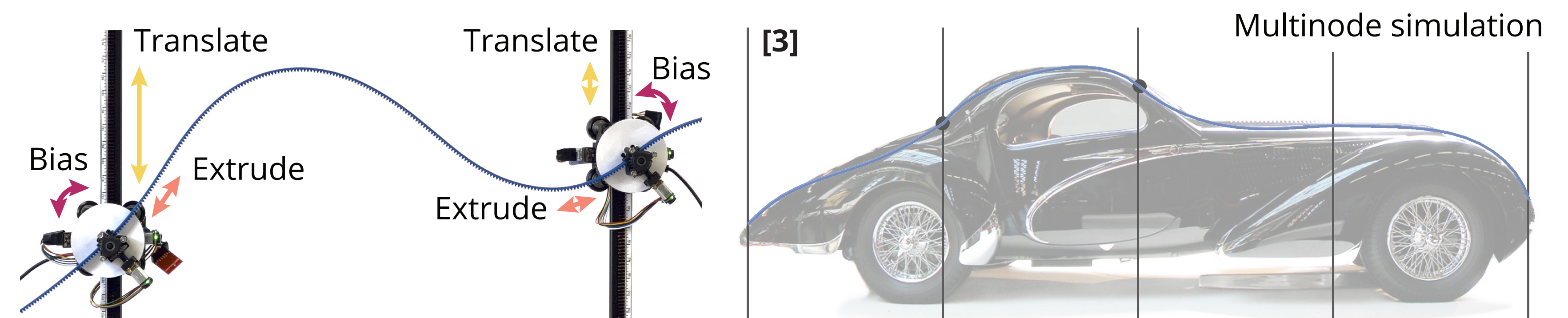


# A Multi-Stable Curved Line Shape Display

WING-SUM LAW, SOFIA DI TORO WYETZNER, RAYMOND ZHEN, SEAN FOLLMER



Curved lines are present in many designs, but are difficult to represent on shape-changing displays.

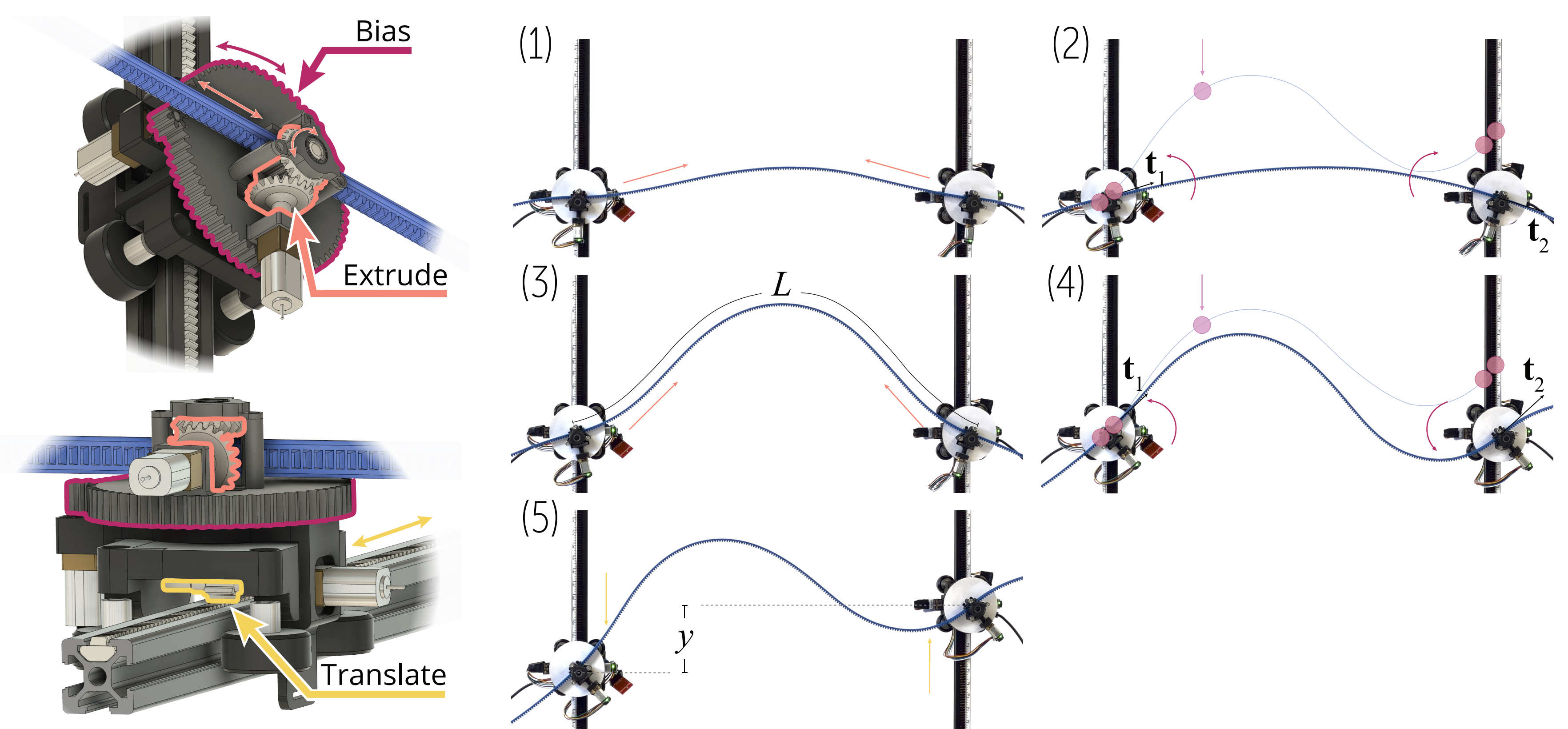


By controlling end pose and arc length of a flexible rod and utilizing system multi-stability, we dynamically display a tactile, curved shapes.

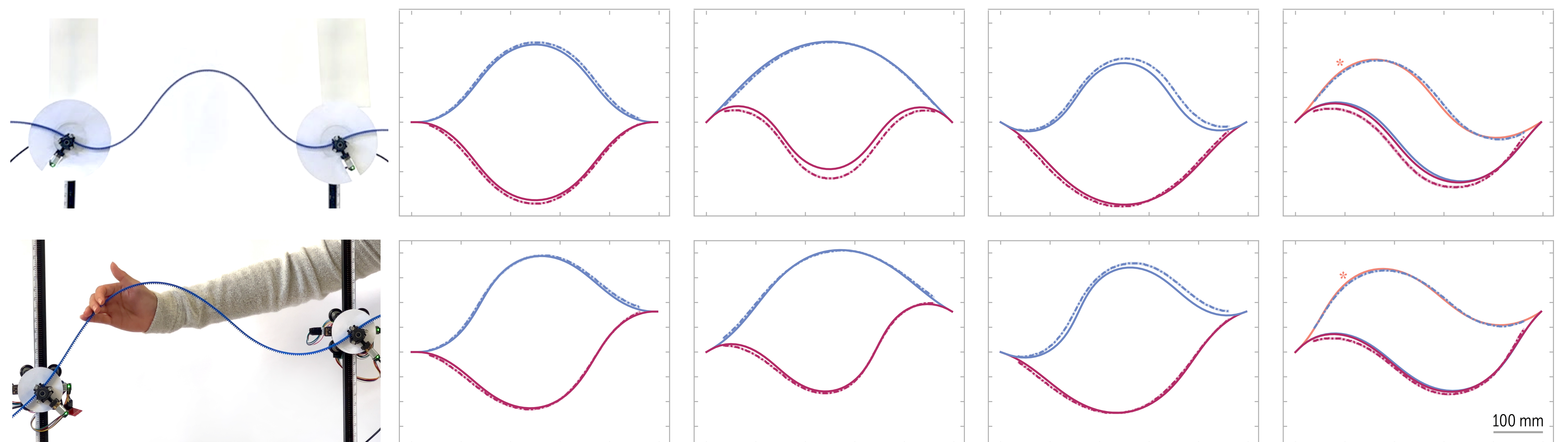
## MOTIVATION

Shape-changing displays have been proposed as haptic devices [4] and computational design tools [5]. However, current shape-changing displays are often composed of discrete, rigid bodies, making it difficult to display smooth, curved surfaces. One way to overcome this limitation is by bending smooth, flexible materials. Due to multi-stability, we model the system and determine the actuation method using separate initializations for a discrete elastic rods model [6-7].

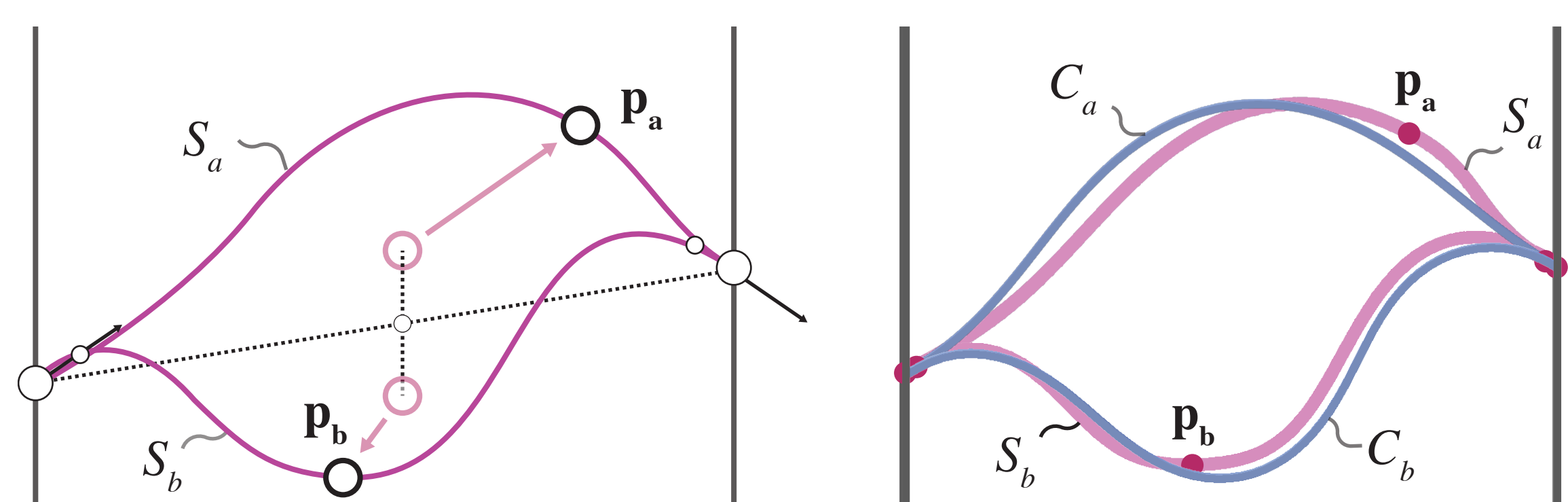
## CURVED LINE SHAPE DISPLAY



## SHAPE GENERATION



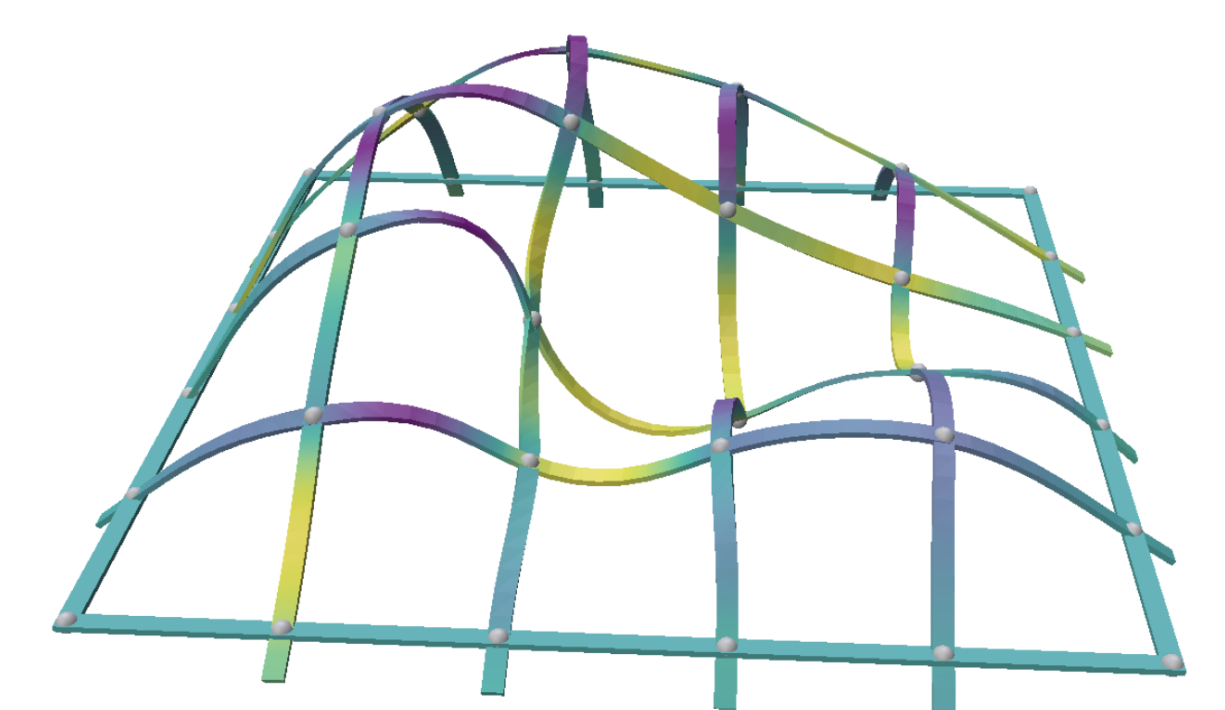
## MODEL



We optimize over control points ( $p_a$  and  $p_b$ ) to match a given arc length and minimize the splines' curvature (left). The two splines,  $S_a$  and  $S_b$ , are used to initialize the solver and relax into physically stable curves  $C_a$  and  $C_b$  (right).

## FUTURE WORK

In future work, we aim to combine many curved line segments into a grid, creating a 2.5D surface.



## REFERENCES

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- [3] "1938 Talbot-Lago T150-C Speciale Teardrop Coupe 5" by Jack Snell is licensed under CC BY 2.0. Background removed and image overlaid.
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