



# Some applications of Spatial Rod Models in Morphology

**Andras A. Sipoş**

Budapest University of Technology and Economics

Date	<b>March 27, 2026</b>
Time	<b>10:30</b>
Room	<b>C2, DICAM, Mesiano</b>

---

Kirchhoff and Cosserat rod theories provide powerful frameworks for predicting the shape of one-dimensional continua under external loads. This talk presents three compelling applications. First, I show that the maximum outreach of a soft robotic arm - modeled as a thin, clamped cantilever - is strongly limited by lateral torsional buckling but can be significantly increased by introducing an appropriate initial curvature. Second, I examine the growth of plant roots, demonstrating that the characteristic morphology of *Arabidopsis thaliana* can be reproduced by extending the classical theory to include environment-dependent differential growth. Finally, I apply rod theory to rigorously prove that a symmetric, circular, pointed masonry arch under self-weight can have at most seven hinges. This result is presented in tribute to Jacques Heyman on the occasion of his 100<sup>th</sup> birthday.

---