Contribution ID: **191** Type: **Oral Presentation**

Growth-induced buckling in elastic rods

Monday, 9 July 2018 16:40 (20 minutes)

Mechanically-induced buckling underlies the shape and function of a number of biological processes, such as brain tissue folding, intestinal crypt fission, and seashell formation. Unlike many typical engineering systems in which buckling is induced by an external compressive load, mechanical instability in biology is driven often by internal growth. In these contexts, it is just as important to consider how the system evolves beyond the onset of instability, as it is to understand when the instability occurs initially.

In this talk, we consider a growing, planar, elastic rod supported by an elastic foundation, as an appropriate starting point a number of possible biological systems. We analyse the post-buckling behaviour through a combination of weakly nonlinear analysis and numerical methods. The effect of different material parameters on the type of buckling and the buckled shape is shown. We then examine how spatial heterogeneity in substrate adhesion, elastic rod stiffness, and growth, impacts both the instability and resultant post-buckled shape evolution. These heterogeneities are contrasted with heterogeneity within the foundation shape, echoing classical results by Koiter on imperfection sensitivity and failure [1]. Finally, we discuss extensions that specialise the model to that of a buckling intestinal crypt.

[1] Van der Heijden, Arnold MA, ed. WT Koiter's elastic stability of solids and structures. Cambridge: Cambridge University Press, 2008.

Primary authors: Mr ALMET, Axel (University of Oxford); Prof. BYRNE, Helen (University of Oxford); Prof. MAINI, Philip (University of Oxford); Prof. MOULTON, Derek (University of Oxford)

Presenter: Mr ALMET, Axel (University of Oxford)

Session Classification: Cellular & tissue processes

Track Classification: Human Physiology