Nonlinear Elasticity: Modelling of Multiphysics and Applications
March 25 - 28, 2024, Edinburgh, UK

Wrinkling instabilities of spinning discs

Ciprian D. Coman

University of Huddersfield, School of Computing & Engineering, UK (c.coman@hud.ac.uk)

Centrifugal tensioning of elastic structures is an important type of loading that is sometimes associated with various forms of elastic instabilities. Circular and cylindrical geometries have been studied extensively by many authors (e.g., [1, 2]). The present contribution will revisit more recent work [3, 4, 5] related to the onset of localised wrinkling deformations in a spinning thin elastic membrane. Our motivation is rooted in the exploration of the asymptotic structure of the related bifurcation equations. The accuracy of the proposed reduced models is confirmed by comparisons with direct numerical simulations of the original stability problems.

REFERENCES

[1] H. Lamb, R.V. Southwell: *The vibration of a spinning disk.* Proceedings of the Royal Society of London A **99**, 272-280 (1921).

[2] D.M. Haughton, R.W. Ogden: *Bifurcations of rotating circular cylindrical elastic membranes.* Mathematical Proceedings of the Cambridge Philosophical Society **87**, 357-376 (1980).

[3] M. Delapierre, D. Chakraborty, J.E. Sader, S. Pellegrino: *Wrinkling of transversely loaded spinning membranes.* International Journal of Solids and Structures **139-140**, 163-173 (2018).

[4] C.D. Coman: *Wrinkling of a normally loaded, spinning, elastic membrane: an asymptotic approximation* International Journal of Non-Linear Mechanics **156**, 104482 (2023).

[5] C.D. Coman: *Shear-induced wrinkling in accelerating thin elastic discs.* (Preprint, University of Huddersfield, June 2023).