The Effects of Pressure Loads in the Dimension Reduction of Elasticity Models

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Abstract

We study the dimensional reduction from three to two dimensions in hyperelastic materials subject to a live load, modeled as a constant pressure force. Our results demonstrate that this loading has a significant impact in higher-order scaling regimes, namely those associated with von Kármán-type theories, where a nontrivial interplay between the elastic energy and the pressure term arises. In contrast, we rigorously show that in lower-order bending regimes, as described by Kirchhoff-type theories, the pressure load does not influence the minimizers. Finally, after identifying the corresponding Γ-limit, we conjecture that a similar independence from the pressure term persists in the most flexible membrane regimes. This is a joint work with F. Riva (Prague).

References

[1] M. Kružík, F. Riva: The effects of pressure loads in the dimension reduction of elasticity models. arXiv:2504.15864v2