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On the edge-wave of a thin elastic plate supported by an elastic half-space

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Edge-wave propagation in thin elastic structures is credited with a long history of investigation, dating back to 1960 and the work by Konenkov [2] and going through a fascinating record of discovery and re-discovery [4]. In this contribution, we consider edge-wave propagating in a thin elastic semi-infinite plate which is bilaterally supported by a homogenous elastic half-space (Fig.1). The problem is formulated in terms of a system of five linear PDEs in the plate transverse displacement and in the scalar and vector elastic potentials with mixed boundary conditions accounting for displacement continuity under the plate and zero normal stress outside. Zero tangential stress is envisaged throughout. The problem is then recast into a Wiener-Hopf functional equation of the second kind in terms of the half-space surface displacement alone [3]. The full-field solution is obtained together with the conditions on the existence of edge-wave-like solutions. This problem follows on a large body of literature on elastic flexural waves and its solution may help cast some light onto the existence condition and the shape of edge waves in elastically supported structures on foundations endowed with a complex non-local character. Results may be useful for modeling edge effects in flexible composite structures and in living tissues embedded in a compliant elastic matrix [1].

References

- [1] M Destrade, Y Fu, and A Nobili. Edge wrinkling in elastically supported pre-stressed incompressible isotropic plates. In *Proc. R. Soc. A*, volume 472, page 20160410. The Royal Society, 2016.
- [2] Y.K. Konenkov. A Rayleigh-type flexural wave. *Sov. Phys. Acoust.*, 6:122–123, 1960.
- [3] A Nobili, E Radi, and L Lanzoni. A cracked infinite kirchhoff plate supported by a two-parameter elastic foundation. *Journal of the European Ceramic Society*, 34(11):2737–2744, 2014.

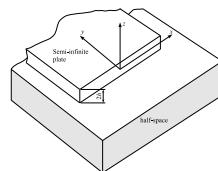


Figure 1: A semi-infinite isotropic elastic plate supported by an isotropic elastic half-space

- [4] A.N. Norris, V.V. Krylov, and I.D. Abrahams. Flexural edge waves and comments on “A new bending wave solution for the classical plate equation” [j. acoust. soc. am. 104, 2220–2222 (1998)]. *The Journal of the Acoustical Society of America*, 107(3):1781–1784, 2000.