BOUNDARY HOMOGENIZATION AND REDUCTION OF DIMENSION IN A KIRCHHOFF-LOVE PLATE

Antonio Gaudiello

DAEIMI, Università degli Studi di Cassino, via G. Di Biasio 43, 03043 Cassino (FR), Italia.
e-mail: gaudiell@unina.it

I present a joint work with Dominique Blanchard (Université de Rouen - France) and Taras A. Mel’nyk (Kyiv Nat. Taras Shevchenko University - Ukraine)

We investigate the asymptotic behavior, as \( \varepsilon \to 0 \), of the Kirchhoff-Love equation satisfied by the transverse displacement \( U_\varepsilon \) of the middle surface \( \Omega^+_\varepsilon \cup \Omega^-_\varepsilon \) (contained in the \( (x_1, x_2) \)-coordinate plane) of a thin three-dimensional plate. The middle surface is composed of two domains. The first one \( \Omega^-_\varepsilon \) is a thin strip with vanishing height \( h_\varepsilon \) (in direction \( x_2 \)), as \( \varepsilon \to 0 \). The second one \( \Omega^+_\varepsilon \) is a comb with fine teeth having small cross section \( \varepsilon \omega \) and constant height, \( \varepsilon \)-periodically distributed (in direction \( x_1 \)) on the upper basis of the thin strip. The middle surface is assumed clamped on the top of the teeth, with a free boundary elsewhere, and subjected to a transverse load.

As \( \varepsilon \to 0 \), in the limit domain \( \Omega^+ \) of the comb, we obtain a continuum bending model of rods. The limit displacement is independent of \( x_2 \) in the rescaled (with respect to \( h_\varepsilon \)) strip \( \Omega^- \). The limit displacement meets a Dirichlet transmission condition between \( \Omega^+ \) and \( \Omega^- \), if \( h_\varepsilon \gg \varepsilon \), or if \( h_\varepsilon \simeq \varepsilon \) and the transverse loads on the thin strip are negligible. While, if \( h_\varepsilon \simeq \varepsilon \) and the transverse loads on the thin strip are strong enough, a discontinuity in the Dirichlet transmission condition appears.