Homogenization theory of the Reissner-Mindlin plate equation

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We study the homogenization of the Reissner–Mindlin plate model

$$\begin{aligned} -\operatorname{div}(P\nabla\vec{\varphi}) + S(\vec{\varphi} + \nabla w) &= \vec{f}, \\ -\operatorname{div}(S(\vec{\varphi} + \nabla w)) &= g, \end{aligned}$$

where w is the transverse displacement and $\vec{\varphi} = (\varphi_1, \varphi_2)$ denotes the rotation of the transverse fibers. The material properties are described by the fourth-order tensor P and the matrix S, while $\vec{f}$ and g are prescribed loadings.

The mathematical foundations of homogenization in the operator framework originate from Spagnolo's concept of G-convergence and were later extended by Murat and Tartar through the theory of H-convergence. Although this theory is well established for second-order elliptic equations, considerably less attention has been devoted to plate models. In recent years, H-convergence has been successfully developed for the Kirchhoff–Love plate, which is appropriate for thin structures since it neglects transverse shear effects.

Our goal is to develop an analogous homogenization theory for the Reissner–Mindlin model, which accounts for transverse shear deformation and is therefore applicable to moderately thick plates. We propose a suitable notion of H-convergence for this system and prove its principal properties, including compactness, locality, independence of boundary conditions, and the existence of correctors.

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