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Thin Elastic Plates Supported over Small Areas. I: Korn's Inequalities and Boundary Layers

A thin anisotropic elastic plate clamped along its lateral side and also supported at a small area θ_h of one base is considered; the diameter of θ_h is of the same order as the plate relative thickness $h \ll 1$. In addition to the standard Kirchhoff model with the Sobolev point condition, a three-dimensional boundary layer is investigated in the vicinity of the support θ_h , which with the help of the derived weighted inequality of Korn's type, will provide an error estimate with the bound $ch^{1/2}|\ln h|$. Ignoring this boundary layer effect reduces the precision order down to $|\ln h|^{-1/2}$.

Keywords: Kirchhoff plate, small support zones, asymptotic analysis, boundary layers, weighted Korn inequality.

MSC: 74K20, 74B05