

## Mathematical Elasticity: Volume II: Theory of Plates (Studies in Mathematics and its Applications)

Phililppe G. Ciarlet



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The objective of Volume II is to show how asymptotic methods, with the thickness as the *small* parameter, indeed provide a powerful means of justifying two-dimensional plate theories. More specifically, without any recourse to any *a priori* assumptions of a geometrical or mechanical nature, it is shown that in the linear case, the three-dimensional displacements, once properly scaled, converge in  $H^1$  towards a limit that satisfies the well-known two-dimensional equations of the linear Kirchhoff-Love theory; the convergence of stress is also established.

In the nonlinear case, again after *ad hoc* scalings have been performed, it is shown that the leading term of a formal asymptotic expansion of the three-dimensional solution satisfies well-known two-dimensional equations, such as those of the nonlinear Kirchhoff-Love theory, or the von Kármán equations. Special attention is also given to the first convergence result obtained in this case, which leads to two-dimensional large deformation, frame-indifferent, nonlinear membrane theories. It is also demonstrated that asymptotic methods can likewise be used for justifying other lower-dimensional equations of elastic shallow shells, and the coupled pluri-dimensional equations of elastic multi-structures, i.e., structures with junctions. In each case, the existence, uniqueness or multiplicity, and regularity of solutions to the limit equations obtained in this fashion are also studied.

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