Shell equations in terms of Günter's derivatives, derived by the Γ-convergence

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Abstract

A mixed boundary value problem for the L\'ame equation in a thin layer $\Omega^h:\cC\times[-h,h]$ around a surface $\cC$ with the Lipshitz boundary is investigated. The main goal is to find out what happens when the thickness of the layer tends to zero $h\to0$. To this end we reformulate BVP into an equivalent variational problem and prove that the energy functional has the Γ-limit being the energy functional on the mid-surface $\cC$. The corresponding BVP on $\cC$, considered as the Γ-limit of the initial BVP, is written in terms of G\"unter's tangential derivatives on $\cC$ and represents a new form of the shell equation. It is shown that the Neumann boundary condition from the initial BVP on the upper and lower surfaces transforms into a right-hand side term of the basic equation of the limit BVP.

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