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The von Kármán theory for incompressible elastic shells.

Starting from the 3d nonlinear elasticity, we rigorously derive the von Kármán thin film theory for incompressible materials. In case of thin plates, the Euler-Lagrange equations of the limiting energy functional give the incompressible version of the classical von Kármán equations, obtained formally in the limit of Poisson's ratio $\nu \to 1/2$. Our analysis applies as well to more general case of shells, i.e. thin films with midsurface of arbitrary geometry, as long as they satisfy the following approximation property: C^3 first order infinitesimal isometries are dense in the space of all $W^{2,2}$ infinitesimal isometries. The class of surfaces with this property includes: subsets of $\mathbb{R}^2$, convex surfaces, developable surfaces and rotationally invariant surfaces. Our analysis relies on the modern methods of calculus of variations and analysis.

This is a joint work with Marta Lewicka. (Received September 01, 2011)