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OPTIMAL THICKNESS OF A CYLINDRICAL SHELL – AN OPTIMAL CONTROL PROBLEM IN LINEAR ELASTICITY THEORY*

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Abstract

In this paper we discuss optimization problems for cylindrical tubes which are loaded by an applied force. This is a problem of optimal control in linear elasticity theory (shape optimization). We are looking for an optimal thickness minimizing the deflection (deformation) of the tube under the influence of an external force. From basic equations of mechanics, we derive the equation of deformation. We apply the displacement approach from shell theory and make use of the hypotheses of Mindlin and Reissner. A corresponding optimal control problem is formulated and first order necessary conditions for the optimal solution (optimal thickness) are derived. We present numerical examples which were solved by the finite element method.

MSC: 49K15, 49J15, 49Q10

keywords: Calculus of variations and optimal control, Problems involving ordinary differential equations, Optimization of shapes other than minimal surfaces

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