OPTIMISATION OF A SANDWICH CIRCULAR PLATE

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Circular and annular plates are structural elements, which are important in theoretical research and in many different fields of practical applications. Circular plates are used in mechanical engineering as the endplates of cylindrical reservoirs, the caps of openings, etc. Axisymmetrical plates are also used as water-resistant partition walls in submarines.

In this presentation, the elastic and elastic-plastic plates subjected to axisymmetrical loadings are considered. The following items are discussed.

Equations of equilibrium, and deformation components for both the geometrically linear and non-linear models of plates are derived in the first part of the presentation.

Differential equations and their general solutions for the bending of the elastic circular plate are also given in this presentation.

In the second and third part of the presentation, circular plates made of an ideal elastic-plastic material are considered. It is assumed that the material of the plate obeys the Tresca yield condition and the associated flow law. It appears that the plastic flow occurs according to the flow regime associated with the maximal value of the circumferential moment (the horizontal side of the Tresca yield hexagon).

The solution of the direct problem of determination of the stress-strain state of the plate is presented, provided the plate operates in the elastic-plastic range.

In the third part of the presentation, a minimum weight design procedure is developed for sandwich plates. It is assumed that the thickness of the carrying layers is piece-wise constant whereas the thickness of the core material is constant. Necessary optimality conditions are derived making use of variational methods of the theory of control.