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Material Tailoring in Functionally Graded Hollow Cylinders under Non-axisymmetric Loads

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We investigate the material tailoring problem for functionally graded hollow cylinders to attain a given state of stress. The volume fractions of two phases of a functionally graded material (FGM) are assumed to vary only with the radius and the effective material properties are estimated by using the Mori-Tanaka scheme. For a FG cylinder under non-axisymmetric loads we determine the required through-the-thickness variation of the volume fraction of the two phases for the hoop stress to be constant through the thickness but have the same periodicity in the circumferential direction as the applied load. It is found that the required radial distribution of the volume fractions of the phases depends on the circumferential wave number of the applied loads. The material tailoring results presented here should help structural engineers and material scientists optimally design hollow cylinders comprised of inhomogeneous materials.

Keywords: Material tailoring, Volume fractions of phases, Functionally graded materials, Hollow cylinders, Non-axisymmetric loads