Zenkour, A.M., Mashat, D.S.

Bending analysis of a ceramic-metal arched bridge using a mixed first-order theory

(2009) *Meccanica*, pp. 1-11. Article in Press.

[a] Department of Mathematics, Faculty of Education, Kafr El-Sheikh University, Kafr El-Sheikh, 33516, Egypt
[b] Department of Mathematics, Faculty of Science, King AbdulAziz University, P.O. Box 80203, Jeddah, 21589, Saudi Arabia

Abstract
In this research, the bending analysis of an arched bridge is presented based on a mixed first-order thick beam one dimensional plate theory. The present arched bridge is considered as a beam with boundary conditions at its edges, which may be simply-supported, and between these two edges, the beam may have quadratic thickness variation. The bridge consists of two layers; the upper flat one is made from an isotropic homogeneous material such as ceramic, and the lower arched layer is made from an isotropic non-homogeneous functionally graded ceramic-metal material. The upper-surface of the arched layer, which represents the interface between the two layers, is ceramic-rich material while the lower-surface of the arched layer is metal-rich material. This structure eliminates interface problem of the arched bridge and thus the stress distributions are smooth. A closed form solution is developed for the static response of such bridge subjected to different distributed loads. The effects of many parameters on the displacements and stresses are investigated. The sample numerical examples presented herein for bending response of the present arched bridge should serve as references for future comparisons. © 2009 Springer Science+Business Media B.V.

Author Keywords
Arched bridges; Beam with variable cross-section; Bending response; Functionally graded material

ISSN: 00256455