Effect of porosity on mechanical response of a functionally graded beams

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Abstract. This work presents a free vibration analysis of functionally graded metal–ceramic (FG) beams with considering porosities that may possibly occur inside the functionally graded materials (FGMs) during their fabrication. A new displacement field containing integrals is proposed which involves only three variables. Based on the suggested theory, the equations of motion are derived from Hamilton's principle. This theory involves only three unknown functions and accounts for parabolic distribution of transverse shear stress. In addition, the transverse shear stresses are vanished at the top and bottom surfaces of the beam. The Navier solution technique is adopted to derive analytical solutions for simply supported beams. The accuracy and effectiveness of proposed model are verified by comparison with previous research. A detailed numerical study is carried out to examine the influence of natural frequencies on th free vibration responses of functionally graded beams.

Keywords: Free vibration; Functionally graded materials; Integral; Hamilton's principle.