6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

ANALYTICAL INVESTIGATION OF A BEAM ON ELASTIC FOUNDATION WITH ASYMMETRICAL PROPERTIES

I. Wstawska[1], P. Kędzia[2] and K. Magnucki[3]

[1] Institute of Applied Mechanics, Poznan University of Technology, Jana Pawła II 24 Street, 60-965 Poznan, iwona.wstawska@put.poznan.pl

[2] Institute of Applied Mechanics, Poznan University of Technology, Jana Pawła II 24 Street, 60-965 Poznan, piotr.kedzia@put.poznan.pl

[3] Institute of Rail Vehicles "TABOR", Warszawska 181 Street, 61-055 Poznan, Poland, krzysztof.magnucki@tabor.com.pl

Key Words: *homogeneous beam, elastic foundation, analytical model, critical force*

The paper deals with a proposition of obtaining an analytical solution of deformation of a beam on an elastic foundation. The subject of presented investigation is the axially compressed beam on the elastic foundation. The analytical model was proposed. Shape function of variable properties of the beam is assumed:

$$c(x) = c_0 - c_1 \, sin^k(\pi\xi) \tag{1}$$

The function of deflection of the homogeneous beam is assumed in the following form:

$$v(x) = v_a \cdot sin\,(m\pi\xi) \cdot sin^n(\pi\xi) \tag{2}$$

The function is assumed to be symmetrical to both ends of the beam. The critical loads $F_{0,CR}$ as a function of the geometrical parameters and mechanical properties of the homogeneous beam were calculated. Further part of research was related to the asymmetrical shape function. The formula has been supplemented with the offset parameter with respect to the left end of the beam. The value of the parameter for symmetrical function is equal $p = 0$.

For symmetrical beam, the highest values of critical loads can be obtained for the highest values of k parameter and the lowest values of c_0/c_1 ratio. The highest value was equal $F_{0,CR}$ = 44.675 kN and was obtained for k=50 and c_0/c_1 = 0.2. For asymmetrical beam, the highest value of critical force was also obtained for the highest values of k parameter and the lowest values of c_0/c_1 ratio ($F_{0,CR}$ = 45.030 kN). The value of p parameter was the variable. The values of critical load increased with the increase of the value of the offset parameter.

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