The influence of delamination and concentrated masses on the free vibrations of Euler beams on Pasternak soil

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Dynamic response of delaminated structures has received a great deal of attention. The presence of delamination may cause changes to the vibration characteristics of the structure and can be the most damaging failure mode of composite materials. Free vibrations of delaminated beams were studied in several papers [1, 2]. Many different models have been proposed [2, 3, 4, 5, 6]. In [3] free vibrations of delaminated beam including the effect of coupling between flexural and longitudinal motion have been examined. Mujumdar and Suryanarayan [4] suggested the model where delaminated layers were constrained having identical transverse deformations. Many practical problems related to soil-structure interactions can be modelled by means of a beam on elastic foundation. Various types of foundation models such as Winkler, Pasternak, Vlasov etc. models have been used in the analysis of beams on elastic foundation. The dynamic analysis of Euler-Bernoulli and Timoshenko beams on Pasternak soil has been investigated in [7, 8].

A general analytical solution for the delaminated composite beam on a two-parameter elastic foundation has been derived in [9]. In [10] free vibration frequencies of a Euler beam on two-parameter elastic soil are calculated in the presence of flexible ends and of a concentrated mass acting along the span.

The aim of the present paper is to develop a mathematical model for determining the natural frequencies and corresponding mode shapes for the Euler beam on Pasternak soil in the presence of delamination and concentrated mass acting along the span at an arbitrary abscissa.

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