# LATERAL FORCED VIBRATION OF BEAM WITH MATERIAL DAMPING

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## ABSTRACT

The paper includes a derivation of the equation of motion for transverse harmonic vibrations of a uniform beam made out of isotropic material with structural damping according to the Voight-Kelvin hypothesis, and also under the Euler-Bernoulli assumption that the plane sections of the beam remain plain during bending. Two solutions of the equation for a cantilever beam were presented; one for a harmonically varying concentrated load at the free end of the beam and another for a harmonically varying uniformly distributed load along the beam. The results included natural frequencies and maximum amplitudes during resonances. The loads were selected in a special way; that the work of the distributed load during static deflection of the beam was equal to the corresponding work under the concentrated load. The results showed that the corresponding resonant frequencies did not differ appreciably between the two cases. However, the corresponding maximum amplitudes varied considerably for higher modes. A discussion of the results included also examples from the industry on the inadequacy of the Eurel-Bernoulli assumption for turbine blades.

**Keywords:** Material damping, turbine blades, vibrations with material damping