

Nonlinear vibrations of simply supported column loaded by the mass element

Sebastian Uzny, Łukasz Kutrowski, Michał Osadnik

Abstract: The stability and free vibrations of slender support systems were the subject of many scientific and research works. This paper presents the boundary problem of column vibrations in which the longitudinal inertia of the mass element, which loads the slender system, is taken into account. The column was analysed as a simply supported structure. The formulation of boundary problem was carried out by using kinetic criterion of stability. The consideration of the load from longitudinal inertia of mass element in the mathematical model means that considered system is nonlinear. The non-linear components occurred in mathematical equations have been developed into a power series of a small parameter. Numerical calculations were carried out, on the basis of which the influence of the amplitude of the column oscillations on the non-linear component of the natural frequency of the system was determined. It has been shown that in the case of supporting systems loaded by mass element, the influence of the vibrations amplitude on natural frequency at appropriately selected parameters of the system is significant.

¹⁾ Sebastian Uzny, Associate Professor: Częstochowa University of Technology, Dąbrowskiego 69, 42-201 Częstochowa, Poland (PL), uzny@imipkm.pcz.pl.

²⁾ Łukasz Kutrowski, M.Sc. (Ph.D. student): Częstochowa University of Technology, Dąbrowskiego 69, 42-201 Częstochowa, Poland (PL), kutrowski@imipkm.pcz.pl.

³⁾ Michał Osadnik, M.Sc. (Ph.D. student): Częstochowa University of Technology, Dąbrowskiego 69, 42-201 Częstochowa, Poland (PL), mosadnik@imipkm.pcz.pl.