

Stability of snaking trailers

Hanna Zsófia Horváth, Dénes Takács

Abstract: The instability of towed vehicles plays a huge role in road transport. If the trailer or semi-trailer is towed within a certain velocity range and it is badly loaded, the vehicle may start a snaking motion. This motion can even lead to the roll-over of the vehicle causing a serious accident. In our study, the mechanical model of the two-wheeled trailer is constructed to describe the spatial motion (even the roll-over) of the trailer. The governing equations are derived with special attention to the non-smoothness and non-linearities that strongly affect the dynamics of the trailer. The presence of unstable limit cycles related to these properties makes the phenomenon mystic from practical point of view. Bistable parameter domains may be observed where large amplitude oscillations and the stable rectilinear motion coexist. The aim of the study is to investigate the effects of the parameters (such as payload position, the stiffness and damping of the suspension and speed) on the linear stability and on the nonlinear vibrations. Our analysis is based both on analytical and numerical techniques.

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- ¹⁾ Hanna Zsófia Horváth, B.A. (M.Sc. student): Budapest University of Technology and Economics, Department of Applied Mechanics, 1111 Budapest, Műgyetem rkp. 3., Hungary (HU), horvath.hanna.zsofia@gmail.com, the author presented this contribution at the conference in the special session "Dynamics of vehicles" organized by A. Harlecki.
- ²⁾ Dénes Takács, Associate Professor: MTA-BME Research Group on Dynamics of Machines and Vehicles, Budapest, Hungary, 1111 Budapest, Műgyetem rkp. 3., Hungary (HU), takacs@mm.bme.hu.