Does a critical speed for railroad vehicles exist? - DTU Orbit (15/12/2018)

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The author discusses the definition and existence of a critical speed for the onset of hunting of railroad vehicles. First the field test situation is described. It is argued that the important problem is the determination of the forces and accelerations in the vehicle and the rails, which may be large even when the vehicle does not hunt. Next the author discusses the relevance of the critical speed in railway engineering. It is desirable to know the speed below which a vehicle will not hunt, since hunting is always connected with large wheel-rail forces. Next the modelling of railroad vehicles is discussed and the nonlinear aspects are emphasized. The author explains why it is necessary to reformulate the mathematical problem for calculation of the critical speed due to the nonlinear character of the modelling. It is suggested that another critical speed be defined for a railroad vehicle. It can be calculated without great effort using a well functioning simulation program. It yields a "global" criterion for the onset of hunting, in contrast to the linear stability criterion, which is still commonly used. The linear eigenvalue problem yields a bifurcation point, which in general will not be the lowest parameter value for existence of oscillating solutions in a nonlinear dynamical system. The author suggests the use of a "nonlinear critical speed" as an acceptance criterion for railroad vehicles.

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