15th INTERNATIONAL CONFERENCE
Dynamical Systems — Theory and Applications
December 2-5, 2019. Lodz, POLAND.

DSTA 2019

paper id: ENG338

On the influence of external stochastic excitation on linear oscillators with subcritical self-excitation applied to brake squeal

Nguyễn Thái Minh Tuấn, Paul Wulff, Nils Gräbner, Utz Von Wagner

Abstract: A characteristic of linear systems with self-excitation is the occurrence of non-normal modes. Because of this non-normality, there may be a significant growth in the vibration amplitude at the beginning of the transient process even in the case of solely negative real parts of the eigenvalues, i.e. subcritical self-excitation and asymptotic stability of the trivial solution. If such a system is excited additionally with white noise with small intensity, this process is continually restarted and a stationary vibration with a dominating single frequency and comparably large amplitudes can be observed. Similar observations can be made during brake squeal, a high-frequency noise resulting from self-excitation due to the frictional disk-pad contact. Although commonly brake squeal is considered as a stable limit cycle with the necessity of corresponding nonlinearities, comparable noise phenomena can in the described model even observed in a pure linear case when the trivial solution is asymptotically stable.

[1] Nguyễn Thái Minh Tuấn, Ph.D.: Department of Applied Mechanics - Hanoi University of Science and Technology, Bộ môn Cơ học ứng dụng - Đại học Bách khoa Hà Nội, Vietnam (VN), nguyenthaiminhtuan@gmail.com.

[2] Paul Wulff, M.Sc.: Department of Applied Mechanics, TU Berlin, Einsteinufer 5, 10587 Berlin, Germany (DE), paul.wulff@tu-berlin.de.

[3] Nils Gräbner, Ph.D.: Department of Applied Mechanics, TU Berlin, Eintseinufer 5, 10587 Berlin, Germany (DE), nils.graebner@tu-berlin.de.

[4] Utz Von Wagner, Professor: Department of Applied Mechanics, TU Berlin, Einsteinufer 5, 10587 Berlin, Germany (DE), utz.vonwagner@tu-berlin.de.