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Mechanik-Seminar

Referent: **Prof. Dr. Valdimir Babitsky**
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Titel: **Autoresonance as a Synergy of Dynamics and Mechatronics for Engineering Application of Nonlinear Modes**

Abstract

The use of nonlinear resonant modes to execute intensive mechanical work is discussed. This can be achieved by condensing the vibration into a sequence of collisions for impulsive action of the tools on the media being treated. The specific of such machining processes, which are ill-defined mathematically, transforms the dynamical system of a machine in a processing regime into a strongly nonlinear system with poorly predictable response to the excitation. Excitation, stabilisation and control of a nonlinear mode at the top intensity and efficiency in such a system is an engineering challenge and needs a new method of adaptive control for its realisation.

Such a control technique was developed with the use of intelligent self-exciting mechatronic systems. The excitation of the nonlinear mode is conducted by positive electronic feedback, which transforms the motion signal to feed a synchronous type power actuators. This leads to dynamic instability of the entire system, which is controlled by identification of the mode and tracing the optimal relationship between phase shifting and limitation in the feedback circuitry. This method of control is called autoresonant.

Effectiveness of the autoresonant control relies on a specific topology of amplitude-phase characteristics of the vibration systems. It is shown that these characteristics retain robust single-valued and gently sloping bell-type configurations for many cases of practical importance regardless of Q-factor and nonlinearity of the vibration system. This allows an efficient vibration of the system in deviating conditions of its parameters, structure and loads.

Applications of autoresonant control for the new machines are described. These are ultrasonically assisted cutting machines intended to intensify machining of intractable materials and screening machines for transportation and separation of granular media.

Dynamics of the autoresonant machines was thoroughly analysed and the results of analysis, design and experimentation are presented. The opportunity of application of the robust and high quality nonlinear resonant system under wide deviation of processing loads results in essential increase of machine productivity, efficiency and improvement of design.

Alle Interessenten sind herzlich eingeladen.
Prof. Dr.-Ing. Alexander Fidlin