Autoresonant control of a parametrically excited vibro-impact screen machine

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Abstract

The problem of excitation and control of parametric resonance is drastically complicated when structure has impact loads as well as complex nonlinearities. In this study, the autoresonance method is applied successfully to control the vibro-impact screen machine [1] due to its ability to deal with nonlinearity and its robustness when confronting systems with a wide range of uncertainties. The control unit in this method includes a sensor, control system unit and actuators. The input of the system is a sensor signal measuring the vibration of screen, and the output is the excitation force generated by the actuator. The control signal in the simplest form shifting the phase of the vibration signal from the sensor and amplifying its magnitude. The powerful signal produced feeds a synchronous type power actuator, which transforms the signal to the excitation force with the same frequency and phase shift calculated by a control system unit. Negative feedback is used to fix the level of amplitude response within the expected range [2-3].

The parametric resonance domain in the screen machine with and without vibro-impact is reported and output tracking of autoresonant control is thoroughly explored. Influence of nonlinear factors is investigated and results of possible applications are discussed. Autoresonant control provides the possibility of self-tuning and self-adaptation mechanisms that allow the vibrating structure to maintain a parametric resonant mode of oscillation under a wide range of uncertainty of mass and viscosity.

References

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