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Effects produced by oscillations applied to nonlinear dynamic systems: a general approach and examples - DTU Orbit (08/11/2017)

Effects produced by oscillations applied to nonlinear dynamic systems: a general approach and examples

A general approach to study effects produced by oscillations applied to nonlinear dynamic systems is developed. It implies a transition from initial governing equations of motion to much more simple equations describing only the main slow component of motions (the vibro-transformed dynamics equations). The approach is named as the oscillatory strobodynamics, since motions are perceived as under a stroboscopic light. The vibro-transformed dynamics equations comprise terms that capture the averaged effect of oscillations. The method of direct separation of motions appears to be an efficient and simple tool to derive these equations. A modification of the method applicable to study problems that do not imply restrictions on the spectrum of excitation frequencies is proposed. It allows also to abandon other restrictions usually introduced when employing the classical asymptotic methods, e.g., the requirement for the involved nonlinearities to be weak. The approach is illustrated by several relevant examples from various fields of science, e.g., mechanics, physics, chemistry and biophysics.

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