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Analytical Methods for Analysis of Transitions to Chaotic Vibrations in Mechanical Systems

Yu.V. Mikhlin [1*], K.V. Avramov [2] and G.V. Rudnyeva [1]

[1] *Department of Applied Mathematics, National Technical University "KhPI", 21 Frunze St., Kharkov 61002, Ukraine*
[2] *Department of Nonstationary Vibrations, A.N. Podgorny Institute for Mechanical Engineering Problems, National Academy of Sciences of Ukraine, 2/10 Dm. Pozharskoho St., 61046, Kharkiv, Ukraine*

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Abstract: Some analytical methods for the analysis of transition to a chaotic behavior in nonlinear mechanical systems are considered here. First, the subharmonic Melnikov–Morozov theory, which is used to study a sequence of the saddle-node bifurcations, is considered. It is shown, that such bifurcations sequence occurs before an appearance of chaotic vibrations. Then, the chaotic dynamics in modulation equations is considered to study chaos in mechanical systems under the action of almost-periodic force, and the heteroclinic Melnikov functions are used to study the chaotic dynamics region. Finally, new approach for the construction of homo- and heteroclinic trajectories in some 2-DOF non-linear dynamical systems is used. Use of the Pade and quasi-Pade approximants, as well these approximants convergence condition make possible to solve boundary-value problems formulated for these orbits and to determine initial amplitude values of the trajectories with admissible precision.

Keywords: *chaotic vibrations; subharmonic bifurcations; homo- and heteroclinic trajectories.*

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* Corresponding author: muv@kpi.kharkov.ua

