

## Nonlinear dynamics of the hierarchic system of oscillators

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*Abstract:* Significant part of materials under appropriate conditions manifests their internal structure. In particular, this concerns the geomedia which are endowed with discrete and hierarchic structure. To examine the dynamics of such systems, we develop the mathematical model [1-3] on the basis of Hamiltonian formalism. This model describes the motion of the hierarchically connected oscillators interacting with each other via the power law. For certain simplifying constrains, we reduce the model to the three level strongly nonlinear system of ODE. The problem considered is the analysis of the system dynamics, when the friction is incorporated and the harmonic force is applied to the most upper level of the system. Using the numerical and qualitative analysis methods, the existence of periodic, quasiperiodic and chaotic attractors are revealed. The bifurcations of these regimes with respect to the structural parameter are studied in more detail. The statistical properties of chaotic attractors are considered as well. [1] Mykulyak S.V., Skurativska I.A., Skurativskiy S.I. Forced nonlinear vibrations in hierarchically constructed media, *Int. J. of Non-Linear Mech.* 98 (2018) 51–57. [2] Mykulyak S., Skurativskiy S. Nonlinear dynamics of the system of hierarchically coupled oscillators with power law interactions. *Int. Conf. on Diff. Eq., Math. Phys. and App. (DEMPHA-2017, Cherkasy, Ukraine)*, p.42-43. [3] Danylenko V.A., Mykulyak S.V., Skurativskiy S.I. Energy redistribution in hierarchical systems of oscillators. *Euro. Phys. J. B.* 2015. 88. P.143(8).

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