

Stability of steady states with regular or chaotic behaviour in time

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Abstract: A stability of the NNMs is analyzed by two approaches. One of them is the method of Ince algebraization, when a new independent variable associated with the unperturbed solution is used instead of time. In this case equations in variations with periodic coefficients transform to equations with singular points. A problem of determination of solutions corresponding to boundaries of the stability/ instability regions is reduced here to the Sturm-Liouville problems for functions that are either regular, or have singularity at the mentioned points. An advantage of the Ince algebraization is that we do not need in use of the unperturbed solution time-presentation. The NNMs concept can be used not only for periodic vibrations. In particular, the NNMs having smooth trajectories in configuration space and chaotic in time behavior can be found in post-buckling forced dynamics of elastic systems that have lost stability under external compressive force. The problem of the chaotic in time modes stability has no analytical solutions. Here some test which is a consequence from the classical Lyapunov definition of stability is proposed and used. It permits to obtain boundaries between the stability/ instability regions in the system parameter space. Both proposed approaches can be used also for other stationary regimes such as traveling or standing waves in nonlinear chains, or in one-dimensional nonlinear media.

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