Estimation of Quality of Non-Stationary Systems on the Return Frequency Characteristic Plane

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Direct quality parameters, such as time of regulation, overshoot, damping decrement are widely used for estimation of linear systems quality. Alongside with direct parameters indirect estimations of quality are used. One of such quality parameters for nonlinear systems is the degree of stability or response speed. A number of research studies show that properties of nonlinear systems investigation is reduced to the analysis of absolute stability of processes. The study considers structural representation of non-stationary linearized system, which allows to present additional evidence the statement of problem and to prove transition to the system with the generalized non-linearity. In general, the non-stationary parametrical characteristic caused by a multiplying part, can be present in four quadrants. However, in most practical problems the characteristic of the multiplying part can be presented as two quadrants, because one of the variables, describing the current value of the parameter is represented by a positive value. The basic features of the block diagram are defined by the fact that a change of Δk factor is equivalent to $\Delta k x_0$ revolting influence caused by entry conditions. Non-stationary properties of the interfaced contour define the free process characterized by transition from the initial state to a steady status of the balance. Entry conditions are defined by an initial contour and are equivalent to the input impact. Thus, the system with a multiplying part can be generally presented as a system with the generalized non-linearity. We studied return the frequency characteristic plane that allows to simplify analytical problems of the systems with two-dimensional non-linearity of multiplying parts. Practical applications demonstrate the algorithm of calculation and analysis of the frequency characteristics for the purpose of their graphic representation and definition of stability.

Keywords: two-dimensional nonlinearity of multipliers, degree of stability, circular criterion, return frequency characteristic.

Received: 05.09.2018 / Accepted: 09.02.2019 / Published online: 28.05.2019

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Cite this article as:
Ivanov V. M. Estimation of Quality of Non-Stationary Systems on the Return Frequency Characteristic Plane. *Izv. Saratov Univ. (N. S.), Ser. Math. Mech. Inform.*, 2019, vol. 19, iss. 2, pp. 207–216 (in Russian). DOI: https://doi.org/10.18500/1816-9791-2019-19-2-207-216