THE CALCULATION OF DYNAMIC EIGENVALUES AND LYAPUNOV-EXPONENTS FOR SECOND ORDER LTV-SYSTEMS

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As is well known, the variational equations of nonlinear dynamic systems are linear time varying (LTV). In the modal solutions of these LTV-systems the earlier introduced dynamic eigenvalues play a key role. They turn out to be the generalization of the classical eigenvalues for linear time invariant (LTI) systems.
In this contribution it is shown for second order systems how the characteristic equation of LTI-systems is generalized to LTV-systems. This is realized in two different ways. One of them can be generalized to higher order systems. It appears that the generalized characteristic equation needs solutions of the Riccati differential equation. For a number of selected examples analytic solutions are obtained. Moreover, an iterative procedure is presented by which the exact solutions are obtained by successive approximation.
Furthermore, it is shown that the real part of the mean value of the dynamic eigenvalue equals the Lyapunov-exponent. For the selected examples, analytic expressions for Lyapunov-exponents are obtained.

Keywords: LTV-systems; dynamic eigenvalues; Lyapunov-exponents; successive approximation.

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