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Software for Determining the Indeces of Causality for Linear Input-Output Dynamic Systems

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Abstract

Essence of causality of input-optput systems has been determined; its quality metering has been shown with the use of causality indeces. Information about the calculation of these indeces of the system with the helps of its matrices of the contiguity and attainability is given. Also software is used which has been developed by the authors for the case of linear dynamic systems in which the processes are described by mathematic modeles with continous and discrete time.

Key words

Linear input-output dynamic system, automatic control system, plant, causality, indexes of causality, definition, calculation, software.

References

- [1] I.A. Krishtal. Spectral analysis of causal operators: dissertation for Candidate. Sci. Sciences degree. Voronezh, 2003 112 p.
- [2] D. C.Youla, H. L.Carlin, L. J. Castriota. Bounded Real Scattering Matrices and the Foundations of Linear Passive Network Theory // IRE Trans. Circuit Theory CT-6. – 1959. – P. 102–124.
- [3] A. Feintuch, R. Saeks. System Theory: A Hilbert Space Approach. New York: Academic press, 1982. 310 pp.
- [4] J. C. Willems. Stability, Instability, Invertibility and Causality, SIAM J. Control. 1969. V. 7. № 4. – P. 645–671.
- [5] R M. DeSantis. Causality, Strict Causality and Invertibility for Systems in Hilbert Resolution Space // SIAM J. Control. – 1974. – V. 12. – № 3. – P. 536–553.
- [6] C. Commault, J. F. Lafay, M. Malabre. Structure of linear systems. Geometric and transfer matrix approaches // Kybernetika. 1991. V. 27. № 3. P. 170–185.
- [7] J. Hammer. Stabilisation of non-linear systems // Int. J. Control. 1986. V. 44. № 5. P. 1349–1381.
- [8] J. Hammer. Robust stabilisation of non-linear systems // Int. J. Control. 1989. V. 49. № 2. P. 629–653.
- [9] J.-T. Chan, L.-F. Wei. Adaptive multi-channel signal tracking controller for minimum or nonminimum phase systems // Int. J. Control. 1989. V. 50. № 1. P. 65–73.
- [10] S. K.Rao, C.-T. Chen. Design of minimal-degree compensators with assignable poles or structure // Automatica. – 1987. – V. 23. – № 2. – P. 241–245.
- [11] H.G. Lee, A. Aropostathis, S. I. Mareus. Linearisation of discrete-time systems // Int. J. Control. 1987. – V. 45. – № 5. – P. 1803–1822.
- [12] G. Roppenecker, B. Lohmann. Vollstandige Modale Synthese von Entkopplungsregelungen // Auto- matisierungstechnik. 1988. V. 36. № 11. S. 434–441.
- [13] A.M. Malyshenko. Defining of Indexes of causality of controlled dynamic systems // News of USSR Academy of Sciences, Technical Cybernetics. 1990. № 1. p. 32-36.
- [14] A.M. Malyshenko. Automatic control system with excess dimension of the control vector. -Tomsk: Publishing House of the Tomsk Polytechnic University, 2005 - 302 p.
- [15] AM Malyshenko. Indices causality of dynamical systems and their use in skhemotehni-cal design and in the evaluation of functional reproducibility of automatic control systems // the Tomsk Polytechnic University, 2013, vol. 323, № 5, c. 37-44.
- [16] A.M. Malyshenko, E.A. Rybakov, E.A. Kochetkov. Software for calculation of indices of linear causality of input-output dynamic systems. Certificate of state registration of the computer number 2013619662 from 11.10.2013.

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