Passive impedance systems and stochastic realizations of stationary processes

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We state the connection between the theory of stochastic realizations ([1]) and the theory of passive impedance systems ([2], [3]). This connection leads us to a new approach to study stochastic processes, linear stochastic systems and corresponding prediction, filtering, stability problems, both in discrete and continuous time cases. We study stationary regular vector processes with spectral densities which are the boundary values of matrix-functions with bounded Nevanlinna characteristic. Such types of stochastic processes give rise of natural and widely used class of realization models. These models lead to simple recursion estimate algorithms called filters. Specifically the processes with rational spectral densities admit minimal realizations with finite-dimensional state spaces which take on the role of such filters.

[1] Lindquist A., Picci G. Realization theory for multivariate stationary Gaussian processes // SIAM J. Control and Optimization 1985, vol. 23, 809-857.

[2] Arov D.Z., Rozhenko N. Passive impedance systems with losses of scattering channels // Ukr. Math. J. 2007, vol. 59 5, 678-707.

[3] Arov D.Z., Rozhenko N. To the theory of passive systems of resistance with losses of scattering channels // Journal of Mathematical Sciences 2009, vol. 156 5, 742-760.

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