

Continuous-Time and Discrete-Time Singular Value Decomposition of an Impulse Response Function

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Abstract : This paper proposes the continuous-time singular value decomposition (SVD) for the impulse response function, a special kind of Green's functions $e^{-(t-\tau)}$, in order to find a set of singular functions and singular values so that the convolutions of such function with the set of singular functions on a specified domain are the solutions to the inhomogeneous differential equations for those singular functions. A numerical example was illustrated to verify the proposed method. Besides the continuous-time SVD, a discrete-time SVD is also presented for the impulse response function, which is modeled using a Toeplitz matrix in the discrete system. The proposed method has broad applications in signal processing, dynamic system analysis, acoustic analysis, thermal analysis, as well as macroeconomic modeling.

Keywords : singular value decomposition, impulse response function, Green's function, Toeplitz matrix, Hankel matrix

Conference Title : ICMEST 2020 : International Conference on Mathematical Engineering, Science and Technology

Conference Location : Tokyo, Japan

Conference Dates : September 10-11, 2020