

Decomposition of Third-Order Discrete-Time Linear Time-Varying Systems into Its Second- and First-Order Pairs

Authors : Mohamed Hassan Abdullahi

Abstract : Decomposition is used as a synthesis tool in several physical systems. It can also be used for tearing and restructuring, which is large-scale system analysis. On the other hand, the commutativity of series-connected systems has fascinated the interest of researchers, and its advantages have been emphasized in the literature. The presentation looks into the necessary conditions for decomposing any third-order discrete-time linear time-varying system into a commutative pair of first- and second-order systems. Additional requirements are derived in the case of nonzero initial conditions. MATLAB simulations are used to verify the findings. The work is unique and is being published for the first time. It is critical from the standpoints of synthesis and/or design. Because many design techniques in engineering systems rely on tearing and reconstruction, this is the process of putting together simple components to create a finished product. Furthermore, it is demonstrated that regarding sensitivity to initial conditions, some combinations may be better than others. The results of this work can be extended for the decomposition of fourth-order discrete-time linear time-varying systems into lower-order commutative pairs, as two second-order commutative subsystems or one first-order and one third-order commutative subsystems.

Keywords : commutativity, decomposition, discrete time-varying systems, systems

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