International Workshop on Dynamical Systems and Applications (IWDSA 2019)
In Memory of Prof. Dr. Aydın Tiryaki
Gazi University, Ankara, Turkey, 3-4 May 2019

State prediction and parameter identification in stochastic State-Space models with time-invariant parameters

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Abstract

A State-Space Model is a mathematical model of a system as a set of input, output and state variables related by first-order differential equations or difference equations. State variables are variables whose values evolve through time in a way that depends on the values they have at any given time and also depends on the externally imposed values of input variables. Space variables values depend on the values of the state variables. State-Space Models are the most commonly used models in almost every area. State prediction concerns statistical inference for the state, based on noisy data coming from partial or indirect measurement access to state variables. Prediction procedure is nicely carried out by the Kalman Filter. Parameters in the state equation must have known values, which are some natural time-invariant constants related to phenomena under study. Sometimes there may exist unknown state parameters, which must be identified. The parameter identification problem can be solved by Kalman Filter via state augmentation. State augmentation results in a nonlinear state equation calling the Extended Kalman Filter (EKF) as an estimation device. The both problems of state prediction and parameter identification are solving simultaneously by EKF. In this study the capabilities of EKF in state prediction and identification of time-invariant unknown parameters are evaluated by simulation.

Key Words: State-Space Model, Estimation, Prediction, Kalman Filter.

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