

SIMULATION AND OPTIMAL FILTERING FOR LINEAR SYSTEMS WITH POISSON WHITE NOISE

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Abstract. This paper presents a simulation algorithm for Poisson white noise in MatLab 7, which results in a MatLab function designed as a Simulink chart. The obtained result is compared to a simulation algorithm for Gaussian white noise that is realized by the built-in MatLab function. Based on the Poisson white noise simulation, the optimal filter for linear systems with Poisson white noises is then simulated and compared to the optimal Kalman-Bucy filter for linear systems with Gaussian white noises. A discussion of the simulation results is provided.

Keywords. Filtering, Linear stochastic system, Poisson white noise.

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1 Introduction

The theory of stochastic systems and signals largely employs the notion of Gaussian white noise, which is obtained as an infinite time series of independent, identically distributed, and uniformly active disturbances (see [13]) and commonly used in practical applications. There is a special MatLab built-in function that simulates it. However, another white noise, the Poisson one, is also frequently encountered in various technical fields, such as aeronautics industry [12], telecommunications [6], market research [9]. Its specific feature and difference from the Gaussian noise consists in its activity only at isolated random time moments, arranged in the so-called Poisson flow [13]. Typical examples of the Poisson flow are a line of customers in a supermarket, cars arriving at a gasoline station, calls to a telephone service, etc. Surprisingly, the Poisson white noise is not simulated by any built-in function in the existing MatLab versions, although some books [6],[7] offer algorithms for generating Poisson random numbers. Some recent papers on optimal and robust filtering (see, for example [2],[4], [15]) also admit presence of white noises of different nature.

This paper presents a simulation algorithm for Poisson white noise in MatLab 7, which results in a MatLab function designed as a Simulink chart. The obtained simulation for Poisson white noise is compared to a simulation for Gaussian white noise that is realized by the built-in MatLab function with