Sampling Reconstruction of Stochastic Signals – The Roots in Fifties

Biserka Draščić

Dept of Sciences, Faculty of Maritime Studies
University of Rijeka, Croatia
e-mail: bdrascic@pfri.hr

Let us given a class of functions which are defined on some common domain. Can we find a discrete subset Λ of this domain such that every member of the class is determined uniquely by the collection of values that it takes on Λ and, if this is the case, how can we recover such a function completely using these "sampled values" only? This is the problem of sampling (analogue to digital transform) and reconstruction (digital to analogue transform).

A major application of sampling theory is in signal analysis. Here it provides the theoretical basis for modern pulse code modulation communication systems, having been introduced by Kotelńikov in 1933 and Shannon in 1949.

In this talk we are interested in the development of the sampling theory in signal analysis of *stochastic signals* in the fifties, especially in three most important papers for further development. First one is the famous paper by Balakrishnan from 1957 where he gave precise mathematical formulation of the Shannon's sampling principle with, what he initiated, the sampling reconstruction of band – limited weakly stationary stochastic processes.

The next two papers are actually the first two ones in which is considered sampling reconstruction of stochastic signals in the almost sure sense, or reconstruction "with probability 1". These are the papers by Belyaev and Lloyd, both from 1959. Here restoration in almost sure sense means that the Kotelńikov formula is valid for almost all sample functions of the considered stochastic signal.

In the talk one gives an overview of the mentioned articles and some further references on this subject for those who are interested will be listed.