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A Stochastic Diffusion Process Based on the Two-Parameters Weibull Density Function

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Abstract : Stochastic modeling concerns the use of probability to model real-world situations in which uncertainty is present. Therefore, the purpose of stochastic modeling is to estimate the probability of outcomes within a forecast, i.e. to be able to predict what conditions or decisions might happen under different situations. In the present study, we present a model of a stochastic diffusion process based on the bi-Weibull distribution function (its trend is proportional to the bi-Weibull probability density function). In general, the Weibull distribution has the ability to assume the characteristics of many different types of distributions. This has made it very popular among engineers and quality practitioners, who have considered it the most commonly used distribution for studying problems such as modeling reliability data, accelerated life testing, and maintainability modeling and analysis. In this work, we start by obtaining the probabilistic characteristics of this model, as the explicit expression of the process, its trends, and its distribution by transforming the diffusion process in a Wiener process as shown in the Ricciaardi theorem. Then, we develop the statistical inference of this model using the maximum likelihood methodology. Finally, we analyse with simulated data the computational problems associated with the parameters, an issue of great importance in its application to real data with the use of the convergence analysis methods. Overall, the use of a stochastic model reflects only a pragmatic decision on the part of the modeler. According to the data that is available and the universe of models known to the modeler, this model represents the best currently available description of the phenomenon under consideration.

Keywords : diffusion process, discrete sampling, likelihood estimation method, simulation, stochastic diffusion process, trends functions, bi-parameters weibull density function
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