The objective of this research is to increase the robustness of discrete-event simulation (DES) when input uncertainties associated models and parameters are present. Input uncertainties in simulation have different sources, including lack of data, conflicting information and beliefs, lack of introspection, measurement errors, and lack of information about dependency. A reliable solution is obtained from a simulation mechanism that accounts for these uncertainty components in simulation.

An interval-based simulation (IBS) mechanism based on imprecise probabilities is proposed, where the statistical distribution parameters in simulation are intervals instead of precise real numbers. This approach incorporates variability and uncertainty in systems. In this research, a standard procedure to estimate interval parameters of probability distributions is developed based on a measurement of simulation robustness. New mechanisms based on the inverse transform to generate interval random variates are proposed. A generic approach to specify the required replication length to achieve a desired level of robustness is derived. Three simulation clock advancement approaches in the interval-based simulation are investigated. A library of java-based IBS toolkits that simulates queueing systems is developed to demonstrate the proposed new reliable simulation. New interval statistics for interval data analysis are proposed to support decision making. To assess the performance of the IBS, we developed an interval-based metamodel for automated material handling systems, which generates interval performance measures that are more reliable and computationally more efficient than traditional DES simulation results.

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The public is welcome to attend.