IMITATION CHALLENGES: FROM UNIFORM RANDOM VARIABLES TO COMPLEX SYSTEMS

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ABSTRACT

In stochastic simulation, we construct mathematical models to imitate the behavior of real systems, use computers to sample behavioral histories (sample paths) of these models, and exploit those samples to improve decision making with the real system. The imitation part can be very challenging, in particular for modeling uncertainty. Fitting univariate probability distribution to data is far from sufficient. Modeling the dependence is very important and much more challenging. It involves multivariate distributions, copulas, stochastic processes, and other complicated stochastic objects. Simulating the model on a computer also involves an imitation game, to simulate the realizations of random variables and stochastic processes with deterministic algorithms on a computer. Random number generation involves writing deterministic computer programs that can imitate simple probabilistic models such as independent uniform random variables uniformly distributed over the interval (0, 1). An "exact" algorithmic implantation of such models is theoretically impossible, so we settle for a reasonable fake. The talk will give snapshots and expose ideas collected from the author's journey thought stochastic simulation. The tour will start with random number generation and visit some challenging problems such as stochastic modeling, simulation-based optimization, rare events, simulation on parallel processors, and future challenges.

AUTHOR BIOGRAPHY

PIERRE L'ECUYER is Professor in the Département d'Informatique et de Recherche Opérationnelle, the Université de Montréal, Canada. He holds the Canada Research Chair in Stochastic Simulation and Optimization. He is a member of the CIRRELT and GERAD research centers, and also benefits from an Inria International Chair in Rennes, France. His main research interests are random number generation, quasi-Monte Carlo methods, efficiency improvement via variance reduction, sensitivity analysis and optimization of discrete-event stochastic systems, and discrete-event simulation in general. He has served as Editor-in-Chief for *ACM Transactions on Modeling and Computer Simulation* from 2010 to 2013. He is currently Associate Editor for *ACM Transactions on Mathematical Software, Statistics and Computing*, and *International Transactions in Operational Research*. He has published over 250 scientific articles and book chapters, and has been a referee for over 130 different scientific journals.