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Nikos E. Mastorakis

Kleanthis Psarris



**Advances in
Software Engineering
and Systems**

Advances in Software Engineering and Systems

*Proceedings of the 14th International Conference on
Software Engineering, Parallel and Distributed Systems (SEPADS '15)*

Dubai, United Arab Emirates, February 22-24, 2015

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Preface

This year the 14th International Conference on Software Engineering, Parallel and Distributed Systems (SEPADS '15) was held in Dubai, United Arab Emirates, February 22-24, 2015. The conference provided a platform to discuss network architecture, wireless networks, data mining, software engineering, software maintenance, hardware engineering, mobile computing, cryptology, algorithms etc. with participants from all over the world, both from academia and from industry.

Its success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of this conferences are published in this Book that will be sent to international indexes. They will be also available in the E-Library of the WSEAS. Extended versions of the best papers will be promoted to many Journals for further evaluation.

Conferences such as this can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Plenary Lecture 1

Random Number Generators with Multiple Streams for Parallel Computers



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Abstract: We discuss the design of software libraries that can provide multiple streams of independent uniform random numbers for simulation in parallel computing environments. These multiple streams are typically defined as disjoint segments of the sequence of numbers produced by a single random number generator (RNG), and which should behave approximately as the realizations of independent random variables uniformly distributed over the interval $(0, 1)$ [2, 4, 5]. These numbers can be transformed appropriately to simulate random variables from other distributions, stochastic processes, and other types of random objects. Thousands or even millions of independent streams of random numbers are sometimes required in parallel computing applications. Multiple streams are also very convenient when running simulations on a single processor, for example to maintain proper synchronization when comparing similar systems with common random numbers (CRNs) and in simulation-based optimization via sample average approximation (SAA) [1, 3, 6, 7].

We give special attention to parallel processing situations where each processor has a limited amount of fast-access private memory, such as for discrete graphical processing units (GPUs) and general-purpose GPUs (GPGPUs).

We introduce `clRNG`, an API and library for uniform random number generation in OpenCL. Streams of random numbers can be seen as virtual random number generators. They can be created on the host computer in unlimited numbers, and then used either on the host or on other computing devices by work items to generate random numbers. Each stream also has equally-spaced substreams, which are useful in certain settings. We provide examples showing the usefulness of streams and substreams in this context, and how the `clRNG` library can be used.

This is based on joint work with David Munger and Nabil Kemerchou.

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Brief Biography of the Speaker: Pierre L'Ecuyer is a Professor in the Département d'Informatique et de Recherche Opérationnelle at the Université de Montréal. He holds the Canada Research Chair in Stochastic Simulation and Optimization since 2004 and an Inria International Chair (at Inria-Rennes, France) for 2013-2018. He obtained the Canadian Operational Research Society Award of Merit in 2014, the INFORMS Simulation Society Distinguished Service Award in 2011, the INFORMS Simulation Society Outstanding Research Publication Award twice, in 1999 and 2009, a Killam Research Fellowship in 2001-03, the Urgel-Archambault Prize from ACFAS in 2002, Steacie Fellowship from the Natural Sciences and Engineering Research Council of Canada (NSERC) in 1995-97, and was elected INFORMS Fellow in 2006.

He has published over 240 scientific articles and book chapters in various areas, including random number generation, quasi-Monte Carlo methods, efficiency improvement in simulation, sensitivity analysis and optimization

for discrete-event simulation models, simulation software, stochastic dynamic programming, and applications in finance, manufacturing, telecommunications, reliability, and service center management. He also developed software libraries and systems for the theoretical and empirical analysis of random number generators and quasi-Monte Carlo point sets, and for general discrete-event simulation. His work impinges on the areas of mathematics, statistics, operations research, economics, and computer science.

He was Editor-in-Chief for the ACM Transactions on Modeling and Computer Simulation until June 2013. He is currently Associate Editor for ACM Transactions on Mathematical Software, Statistics and Computing, Cryptography and Communications, and International Transactions in Operational Research. He has been a referee for over 130 different scientific journals, plus many books and conference proceedings.

He was a professor in the Departement d'Informatique at Universite Laval (Quebec) from 1983 to 1990 and is at the Universite de Montreal since then. He has been a visiting scholar (for several months) at Stanford University (USA), INRIA-Rocquencourt (France), Ecole des Mines (France), Waseda University (Tokyo), University of Salzburg (Austria), North Carolina State University (USA), INRIA-Rennes (France), and Universite de Savoie in Chambéry (France). He is a member of the CIRRELT and GERAD research centers, in Montreal.

He is a competitive cyclist in road racing, with four titles of Canadian Champion and ten titles of Quebec Champion.