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Open post-doc position:

Importance Splitting Simulation for Rare Event Analysis

Being able to evaluate the probability of rare events is critical in many applications, such as control flight systems, reliability analysis, or insurance risks for instance. Simulation becomes mandatory when the state space is large, but acceleration techniques are required to improve its efficiency when the analysis aims at evaluating a small probability. Importance sampling and importance splitting are the two primary techniques in this direction.

A postdoctoral fellowship is offered to focus on importance splitting techniques which basically consist of terminating the trajectories which seem to go away from the rare event, and cloning those seeming to go in the right direction. Several research problems could be investigated during this one year term:

- While the literature was focusing on steady-state estimation, we could be interested in transient analysis. How to set the thresholds in splitting techniques with respect to the additional parameter, the remaining time?
- Some preliminary works have been initiated on combining importance splitting with randomized quasi-Monte Carlo that, said simply, accelerate the convergence rate of Monte Carlo [1]. This work needs to be pushed a step forward.
- A method combining importance sampling and importance splitting, making use of weight windows [2], needs further theoretical analysis, and can be applied to reliability and control flight problems, among others.

The context of the work is the INRIA's cooperative action RARE http://www.irisa.fr/armor/Rare, a project devoted to rare event simulation. The supervision will be coordinated by both ARMOR and ASPI project-teams at INRIA Rennes.

[1] V. Demers, P. L'Ecuyer and B. Tuffin. A Combination of Randomized Quasi-Monte Carlo with Splitting for Rare-Event Simulation. In *Proceedings of th 2005 European Simulation Conference (ESM'05)*, SCS Press, Porto, Oct. 2005.

[2] T.E. Booth. Automatic importance estimation in forward Monte Carlo calculations. *Transactions of the American Nuclear Society* 41, pages 308-309, 1982.

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