

PSI2 : Envelope Perfect Sampling of Non Monotone Systems

Ana Bušić¹, Bruno Gaujal^{2,3}
Gaël Gorgo^{2,3} and **Jean-Marc Vincent**^{2,3}

¹INRIA/ENS Paris ²INRIA-Rhône-Alpes ³Laboratoire d'Informatique de Grenoble

Outline

- 1 Motivations
- 2 Perfect Sampling
- 3 Sampling efficiency
- 4 Future Work and References



Work partially supported by ANR Setin Checkbound

Perfect Sampling of Complex Large Scale Markov Chains

Applications

- Finite queuing networks (dynamic routing)
- Call centers
- Grid/cluster scheduling
- Rare event estimation
- Statistical verification of program

Models

- Discrete vector state-space \mathcal{X}
- Event based models

$$X_{n+1} = \Phi(X_n, e_{n+1}), e_n \in \mathcal{E}$$

Stochastic recurrence equation

- Independent events (iid)

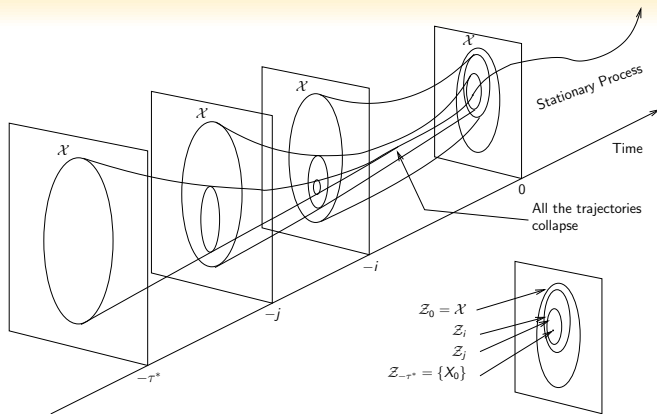
Provide **independent** samples of **stationary** states.

PSI2 : a Perfect Sampler

- Library of **monotone** events
- Simulation kernel
- Efficient simulator : polynomial in the model dimension

⇒ **Extension to non-monotone events**

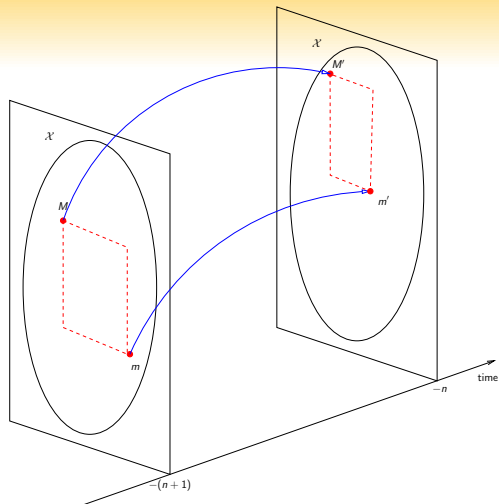
Perfect Sampling Principle



Synchronizing pattern \implies finite backward scheme $\tau^* < \infty$

[NSMC 2003, LAA 2004]

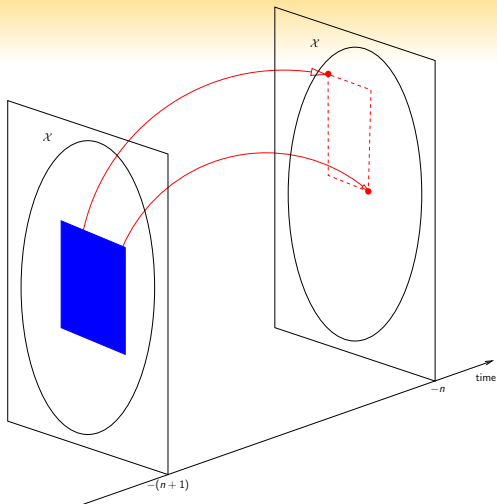
Monotone Perfect Sampling



same convergence condition

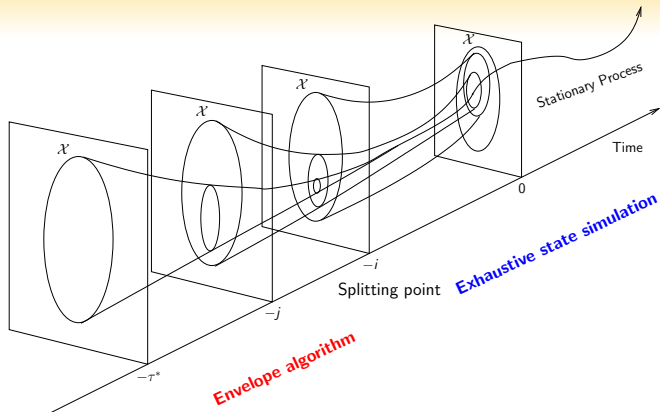
complexity in $\mathcal{O}(\mathbb{E}\tau^*)$ \Rightarrow polynomial in model dimension

Envelopes Perfect Sampling



Synchronizing pattern for envelopes
complexity unknown but practically efficient

Envelopes and Splitting Perfect Sampling

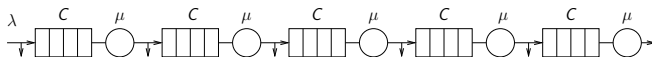


Guarantees the convergence
complexity unknown but practically more efficient

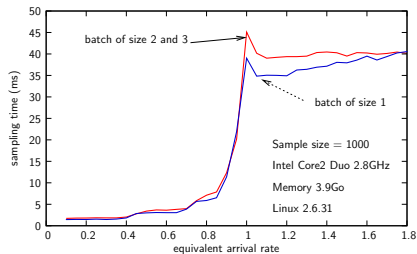
[VALUETOOLS 2008]

Batch arrivals

Batch arrival B

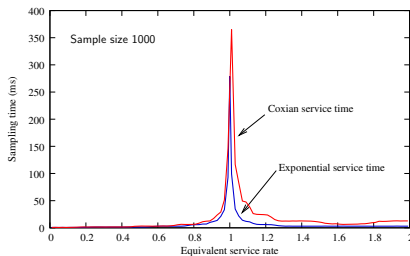
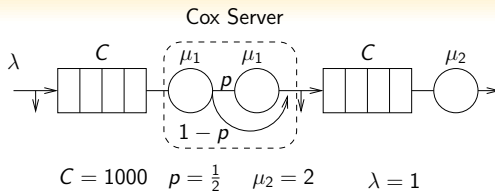


$C = 200$ $\mu = 1$ $B = 2$ with probability $\frac{1}{2}$ and $B = 3$ with probability $\frac{1}{2}$



⇒ **Almost monotone systems**

Coxian queues



⇒ **pre-computation for phase-type distribution**

Synthesis

Non-monotone events

- Negative customers, join, ...(frontier in 0)
- Batch arrivals or services (large coupling time \Rightarrow splitting)
- Event triggering on non-monotone condition
- Coxian and phase-type distribution (transform the state-space)
- ...

Ψ^2 Implementation

- adaptation of the kernel
- user defined envelopes process
- basic events in the library

Some references

- **Methodological reference**
A. Bušić, B. Gaujal, J-M Vincent. Perfect Simulation and Non-monotone Markovian Systems. Valuetools'08, Athens, 2008
- **Non-monotone load-sharing policies**
G. Gorgo, J-M Vincent. Perfect Sampling of Load Sharing Policies in Large Scale Distributed Systems. ASMTA, LNCS, 6148
- **Performance comparison in statistical model-checking**
D. Elrabih, G. Gorgo, N. Pekergin, J-M. Vincent. Steady-state Property Verification : a Comparison Study. VECoS, Paris, 2010.

Download : <http://gforge.inria.fr/projects/psi>

INRIAGForge: Perfect Simulator: Information sur un projet

inria.fr <https://gforge.inria.fr/projects/psi>

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accueil ma page arbre des projets demande d'aide **perfect simulator**

résumé administration activité outil de suivi listes tâches annonces sources fichiers

Résumé

PSI is a software simulator of Markov chains on large discrete state space. It samples steady state distribution in finite time by the method "coupling from the past".

- Intended Audience : End Users/Desktop
- Intended Audience : Other Audience
- Kind : Software
- License : OSI Approved : GNU General Public License (GPL)
- Natural Language : English
- Natural Language : French
- Operating System : MacOS
- Operating System : POSIX : Linux
- Programming Language : C
- Research center : Montbonnot
- Topic : Scientific/Engineering

Enregistré le : 24/11/2005 17:37
 Taux d'activité : 0%
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Equipe-Projet

Administrateurs du projet:
 Gael Gorgo
 Jean-Marc Vincent
 Jérôme Vienne
 Thais Webber
 Vincent Danjean
 Développeurs:
 Ana Basic
 Arnaud Legrand
 Florentine Dubois
 Nihal Pekergin
 Noémie Sidaner
 Vandy BERTEN

[Voir les membres]

Derniers fichiers publiés

Paquet	Version	Date	Remarques / Surveiller	Télécharger (download)
psi	4.4.6	March 24, 2010		Télécharger (download)

[Voir tous les fichiers du projet]

Zones publiques

[Page d'accueil du projet](#)

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Version 4.4.6 is available
 Jean-Marc Vincent - 14/06/2010 16:13
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