

*The Hong Kong Polytechnic University
Department of Logistics and Maritime Studies
Research Seminar*

From RG-Factorizations to Black Hole Effect in Stochastic Models

by

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Date: 4 November 2016 (Friday)
Time: 10:30am - 11:30am
Venue: R402, Shirley Chan Building
The Hong Kong Polytechnic University

(Conducted in English)

Abstract:

This talk contains two parts: The first one is to introduce our research on numerical computation in general stochastic models from 1997 to 2009. Our purpose is to extend and generalize the matrix-geometric solution by Marcel F. Neuts to be able to deal with more general stochastic models due to those practical needs from more and more stochastic systems. To that end, we found two types of (abbreviated as UDL-type and LDU-type) RG-factorizations from any irreducible Markov process (and other processes) through a constructive censoring technique with higher skill. Our results are simple and beautiful, and also they are easily applicable to computation of the steady-state probability vectors of general Markov processes by means of the UDL-type RG-factorization as well as calculation of various transient performance measures of stochastic models in terms of the LDU-type RG-factorization. Notice that our research improves and develops Neuts' theory into a new and unified framework because of applying the UDL-type and LDU-type RG-factorizations. Some detailed information is given in my book: ***Constructive Computation in Stochastic Models with Applications: The RG-Factorizations***, Springer, 2010; and its Springer homepage: <http://link.springer.com/book/10.1007/978-3-642-11492-2>

The second one of this talk is to introduce our works on Nonlinear Markov Processes in Big Networks through mean-field theory and RG-factorizations. We have applied the mean-field theory as well as RG-

factorizations to discuss such nonlinear Markov processes from practically large-scale stochastic systems including supermarket models, work stealing models, bike-sharing systems and healthcare systems. Based on this, we found that Black Hole Effect is a basic phenomenon in Big (Economy) Networks. For understanding the black hole effect, we are developing three key topics: (a) Multiple stable domains, and cross-domain movement; (b) existence of black hole effect, and metrology of black hole effect; and (c) loss of resources from black hole effect, and useful relationship between network efficiency and network benefit under artificial control mechanisms. Our results provide some irregular characteristics and insight in the study of large-scale stochastic systems, which may be useful in design, optimization, control and management of many real applied systems.

Bio:

Quan-Lin Li is Full Professor in School of Economics and Management Sciences, Yanshan University, Qinhuangdao, China. He received the Ph.D. degree in Institute of Applied Mathematics, Chinese Academy of Sciences, Beijing, China in 1998. His main research interests concern with Markov Processes, Queueing Theory, Stochastic Models, Matrix-Analytic Methods, Manufacturing Systems, Computer Networks, Network Security, Healthcare Systems, and Supply Chain Management.

Dr. Li has published a book: *Constructive Computation in Stochastic Models with Applications: The RG-Factorizations*, Springer, 2010; and over 50 research papers in a variety of international journals, such as, *Advances in Applied Probability*, *Queueing Systems*, *Stochastic Models*, *European Journal of Operational Research*, *Computer Networks*, *Performance Evaluation*, *Discrete Event Dynamic Systems*, *Computers & Operations Research*, *Annals of Operations Research*, *International Journal of Production Economics*, and *Computers & Mathematics with Applications*. In addition, He is in International Program Committees in the conferences of several different areas, such as, queueing systems, stochastic models, and computer networks. Also, he is a vice president of Reliability Society in Operations Research Society of China.

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All are welcome!