Stochastic modeling of communication systems. II

(Expanded Course)

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Description:

Queueing theory plays a key role in the performance analysis of modern telecommunication networks covering models of data packets/calls moving among computers, models of buffers and switching stations, transfer of signals/packets between processors. Stochastic queueing systems are recognized among the most adequate mathematical models of such systems. The key issues concerning stochastic queueing system include estimation/calculation of the average delay, loss probability, average sojourn time, quality of service (QoS) guarantee, stability analysis, and so on.

The series of lectures is a continuation of the 1st part of the course given at the University of Oulu in December 2010. This 2nd part contains basics of probability theory and stochastic queueing processes; regenerative and fluid stability analysis of queueing systems; analysis of self-similar, long-range dependent and heavy-tailed telecommunication processes. A large deviation approach to queues and effective bandwidth concept are also discussed. Basic models and intuitive explanation of the underlying ideas and assumptions are discussed in detail, while mathematical techniques play a secondary role. Classroom exercises are included.

Brief Bio:

Professor Evsey Morozov is a leading researcher at the Institute of Applied Mathematical Research, Karelian Research Centre, Russian Academy of Sciences, and Professor at the Mathematical Faculty of the Petrozavodsk State University. His research interests include regenerative performance and stability analysis of queues, rare event simulation, fluid stability analysis, Gaussian queues, long-range dependent network processes, optical buffers, retrial queues. He has more than 100 research publications and has visited a numerous international seminars and conferences devoted to stochastic analysis of communication systems. He has been invited as Visiting Professor to the Graduate School of University of Helsinki (intensive course on stochastic modeling of communication networks, 2002); the University of Aizu, Japan (2003); University Marne-la-Vallee, France (2004); Institute Mittag-Leffler (research program, 2004); University of Kuopio (intensive courses, 2005, 2007); University of Zaragoza (intensive course, 2005); Lille Polytech (2006); University of Pisa (intensive course, 2006); Center of mathematical research of Catalonia (research programs, 2007, 2009, 2011); Tel-Aviv University (2007); University of Ghent (joint research programs, 2007, 2009); University of Warwick (2011). He has joint research with Universities of Ghent, Pisa, Barcelona, with INRIA. Homepage: http://mathem.krc.karelia.ru/member.php?id=19&plang=e

Course Contents:

Day	Topics	Classes (45 min)
1	1. Basics of Probability theory 2. Stochastic processes: introduction	2 2
2	3. Special processes: renewal process, Brownian motion, random walk, Markov chains; limit laws	4
3	4. Queueing systems: regeneration and Harris recurrence 5. Coupling and monotonicity of queues	2 2
4	5. Fluid analysis 6. Regenerative stability analysis and simulation	2 2
5	7. Large deviation in queues	4
6.	8. Introduction to Effective Bandwidths 9. Heavy- tailed distributions	3 1
7.	10. Self-similar telecommunication processes 11. Long-range dependent traffic	2 2
8.	Exercise session	3
9.	Exam (13:00-17:00)	3

Conduction: Mandatory Lectures and Written Exam (with material)
Students need to attend the course, to be eligible for the exam.

Literature: Will be listed in the beginning of lectures.

The amount of credits is yet to be confirmed.