

## R e s u m e

**School and University.** My name is Vyacheslav (Slava) Abramov. My first language is Russian. I was born on September 12, 1955 in Dushanbe, the capital of Tadjik Republic. The high school where I studied, School number 1, was a school with mathematics, physics and chemistry background, the most prestigious school in our city. A large number of scientists, engineers and public people had originally graduated from this school.

I graduated from this school in 1972. In the same year I attended the Applied Mathematics Department of the Tadjik State University. I studied there during 1972-1977, and in 1977 I graduated. My master work was entitled: "A queueing system with service depending on a queue-length". My scientific supervisor was Docent, a head of the Applied Mathematics Department, Eduard Samandarov. After finishing the University, during 1977-1992 I worked at the Research Institute of Economics under the Tadjikistan State Planning Committee. There I continued to develop the results of my thesis, and published a number of papers related to this topic, and the book that was published in 1991 in Donish Inc. (Dushanbe) of the Tadjikistan Academy of Sciences. Unfortunately, the political situation in the former USSR at the end of 80th and at the beginning of 90th of the twentieth century did not permit me to defend a dissertation to get the "Doctor of Philosophy" degree. In 1992 I left the country and came to Israel.

**Israel and the PhD study.** During the first years staying in Israel I tried to continue my education, but my attempts were unsuccessful. After several years I finished programming courses and then worked in different hi-tech companies and industry as a statistician, programmer and algorithms developer. At the same time I continued the scientific work as a hobby and published a few papers. In 2000 I was invited to INRIA Sophia Antipolis to work for a project during the summer period of that year. Then returning to Israel I continued to work in a hi-tech company. In 2002 I was invited to the *First Madrid Conference on Queueing Theory*, where I have a contributed talk. Returning to Israel I entered the School of Mathematical Sciences as a PhD student, so I started a PhD study having a number of serious publications and experience in the research and life. This period of time I worked at the Tel Aviv University, Judea and Samaria College at Ariel and Holon Institute of Technology as tutor, lecturer and researcher.

The PhD dissertation was finished at the beginning of 2004. My PhD work was entitled "Asymptotic methods for queueing systems and networks with application to telecommunications". The scientific advisors of this work were Professors Robert Liptser and Zeev Schuss.

At the beginning of 2005 I joined the Centre for Modelling of Stochastic Systems at Monash University (Australia).

**The scientific achievements.** My study focuses on stochastic systems, and specifically on the theory and applications of queueing theory. Within queueing theory, my research covers many significant topics of this area including loss systems, telecommunication systems, retrial queues, control of dams/storage systems, analytic methods in queueing theory and stochastic calculus methods.

My most significant contribution is related to loss systems in queueing theory. Loss systems is one of the most important areas of queueing theory because of its close relation to telecommunication systems. I was the first person to prove the

fundamental result in the theory of loss queueing systems: *If in the  $M/GI/1/n$  queueing system the expectation of inter-arrival and service times are equal, then the expectation of the number of losses during the busy period is equal to 1 for all  $n$ .*

This theoretical contribution has impacted very significantly on the research of many scientists worldwide. R. Richter, E. Pekös, R. Wolff, C. Xia, A. Pacheco, H. Ribeiro have applied and developed this theoretical result in many of their papers.

Along with this specific result, I have discovered many new results on queueing theory related to loss queueing systems, which are also well-recognized in the scientific community. In my recent papers [Abramov, V.M. *Ann. Oper. Res.*, 112 (2002), 35-41] and [Abramov, V.M. *Qual. Technol. Quantit. Manag.*, 4 (2007), 379-393] I have solved the problem of losses in the area of heavy traffic theory, which had been formulated as an open problem in the paper [Whitt, W. *Queueing Syst.*, 46 (2004), 507-536] (in which the problem was that of changing the order of limits). In another paper [Abramov, V.M. *J. Appl. Probab.*, 38 (2001), 232-234] I have suggested an elegant method of obtaining simple stochastic inequalities based on the application of the level-crossing approach and a reduction of level-crossings used in the theory of Galton-Watson branching processes. This idea has been substantially developed in a later paper [Abramov, V.M. *Stoch. Anal. Appl.*, 24 (2006), 1205-1221], where the method has been applied to a wide class of loss systems. The further development of this idea culminated in a recent paper [Abramov, V.M. *Queueing Syst.*, 59 (2008), 63-86], where I established the continuity of losses in  $M/M/1/n$  queues. The problem of continuity of queues is very important. It is a very difficult problem. The known results of this theory are under very restrictive assumptions, which are unable to be used in practice. I could solve this problem under very realistic assumptions on the properties of distributions. Moreover, the solution provided in my paper is very comprehensive. I obtained both uniform estimates and local estimates and studied different classes of service time distributions.

One of the key themes of my research is the application of the level-crossing approach. The level-crossing approach is very familiar in queueing theory. It goes back to the celebrated paper of Cohen [Cohen, J.W. *J. Appl. Probab.*, 14 (1977), 405-410] and a number of papers of Brill, P.H. and Posner, M.J.M. I suggested a new level-crossing approach in which level-crossings are considered as a stochastic process (where 'level' is associated with 'time'). In the simplest case of the  $M/M/1$  queueing system the level-crossing is a Galton-Watson branching process. In many other cases, which are more complicated, the consideration reduces to Galton-Watson processes again. Some complex systems require a development of that level-crossing approach, and the process must then have a more complicated structure. Nevertheless, in most cases my methodology substantially simplifies the analysis and enables us to solve many difficult and previously unsolved problems. The new method of level-crossing had been initiated in my book [Abramov, V.M. *Investigation of a Queueing System with Service Depending on Queue-Length*, Donish Co., Dushanbe (1991)] and then used in many of my papers related to loss queueing systems, the theory of epidemics [Abramov, V.M. *J. Appl. Probab.*, 31 (1994), 606-613] and (in one of my papers) to large loss communication networks [Abramov, V.M. *Queueing Syst.*, 38 (2001), 149-184].

The theory of computer networks is another area in which I have made significant contributions. Before my papers were published, the area had been intensively

developed. One of the most significant papers in this area was the paper of Kogan and Liptser [Kogan, Ya., Liptser, R.Sh. *Queueing Syst.*, 14 (1993), 33-55], which studied a Markovian closed computer network with bottlenecks. I substantially developed the earlier analysis and was able to apply it for non-Markovian networks. Specifically, I solved a difficult problem of deriving the asymptotic distribution of queue-length processes in non-bottleneck stations in the presence of one bottleneck station [Abramov, V.M. *Queueing Syst.*, 35 (2000), 23-54]. I showed that the structure of the queue-length distribution substantially differs from those obtained under Markovian settings and closely related to the DSTA (departures see time averages) property when the distribution of service times approaches an exponential distribution. These results were then substantially developed in my future research for more complicated and realistic communication networks [Abramov, V.M. *Queueing Syst.*, 48 (2004), 45-73], [Abramov, V.M. *Acta Appl. Math.*, 100 (2008), 201-226]. The main method of analysis in these papers is the modern stochastic calculus.

My contribution to the area of *Retrial Queueing Systems* is also based on the methods of stochastic calculus. The method has helped me to solve advanced new problems related to non-Markovian retrial queues. (A complex structure of retrial queues did not permit earlier researchers to study these systems under non-Markovian settings.) The results related to the theory of retrial queues have been published in [Abramov, V.M. *Ann. Operat. Res.*, 141 (2006), 19-50] and [Abramov, V.M. *ANZIAM J.*, 48 (2007), 297-314].

The modern methods of stochastic calculus also helped me to solve the *Effective Bandwidth Problem* in a new and advanced formulation. My paper on this subject is [Abramov, V.M. *Stoch. Models*, 24 (2008), 527-577].

A large part of my research uses the advanced analytic techniques of Mathematical Analysis. By using modern Tauberian theorems, I contributed substantially both to queueing theory and in applications of queueing theory to large telecommunication systems, dam/storage systems and the effective bandwidth problem. My recent survey paper [Abramov, V.M. *Acta Appl. Math.* (2009), to appear] covers overall results in this area of research.