

Evolution of Resource Loss Systems and its Application to Performance Analysis of Wireless Networks

(based on the book «Matrix and analytical methods for performance analysis of telecommunication systems» dedicated to our teacher Gely Basharin and written by Valeriy Naumov, Yuliya Gaidamaka, Natalia Yarkina, Konstantin Samouylov)

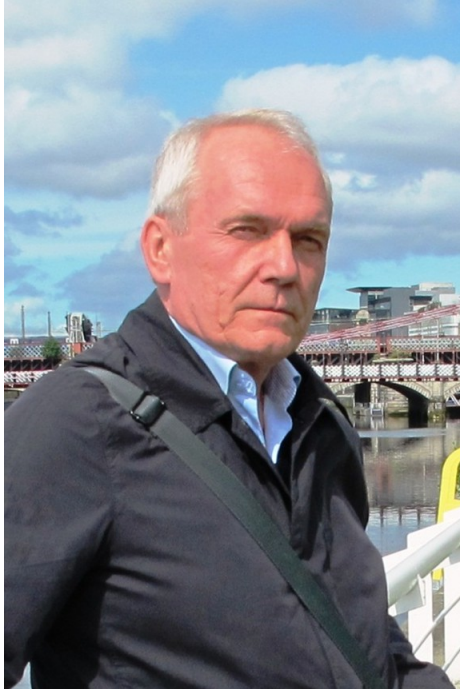
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Mathematical analysis plays an indisputable role in almost all spheres of human activity. The world public telecommunications network is the largest technical object that a human has ever built. This network has been created since about the end of the 19th century and has survived all the stages of the development of industrial society. By 2020, 5 generations of the telecommunication network have already been created, and the scientific community is already discussing the networks of the future 6th generation of the network. At all stages, starting from the tasks set by the outstanding mathematicians Agner Erlang and Aleksandr Khinchin, engineers turned to various mathematical theories and methods both to evaluate the performance of existing networks as well as to build models of future systems, even those that have not yet passed the laboratory research stage. Almost no scientific article devoted to the R&D of telecommunication systems and networks is complete without the construction of mathematical models and their mathematical analysis. The created methods in some cases served the development of purely mathematical disciplines such, as queuing theory, coding theory, and some others.

We devote this keynote to the problems of the application of mathematical analysis in telecommunications and base it on the book «Matrix and analytical methods for performance analysis of telecommunication systems» dedicated to our teacher Gely Basharin and written by Valeriy Naumov, Yuliya Gaidamaka, Natalia Yarkina, Konstantin Samouylov. Of course, it is impossible in one speech to even briefly outline a book that describes the research of RUDN University mathematicians for about 60 years. The presentation will be focused on the part where the evolution of models is sequentially presented, starting from the famous Erlang formula, and up to the Resource Loss Systems we have built, aimed at analyzing new generations of wireless networks.

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Short Bio: Konstantin Samouylov received his PhD in physics and mathematics in probability theory from Moscow State University in 1985 and his Doctor of Engineering in telecommunications from the Moscow Technical University of Communications and Informatics in 2005. From 1985 to 1996, he held several positions in the Faculty of Physics and Mathematics at the Peoples' Friendships University of Russia (RUDN University), where he became head of the Department of Telecommunication Systems in 1996. Since 2024, he has headed the Department of Probability Theory and Cybersecurity and is also the director of the Institute of Computer Science and Telecommunications at RUDN University. He is a member of the editorial boards and a reviewer for several scientific journals, and a co-chair and member of the program committees of international conferences. His current research interests include applied aspects of probability theory and stochastic processes, queuing theory and mathematical theory of teletraffic, methods the 5G/6G networks performance analysis, resource allocation in heterogeneous wireless networks, wireless network slicing, IAB, DECT2020, URLLC and eMBB. He is the author and co-author of more than 250 scientific articles and seven books.

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Yuliya Gaidamaka received a PhD in 2001 and a Full Doctor of Sciences degree in 2017 in Mathematics from the Peoples' Friendship University of Russia (RUDN University). Since 2001, she has been an associate professor and currently a professor in the university's Probability Theory and Cybersecurity Department. She is the author of more than 200 scientific and conference papers, co-author of three monographs on multiplicative solutions of finite Markov chains, matrix and analytical methods for performance analysis of wireless heterogeneous networks. Her current research focuses on performance analysis of 5G+ networks, queuing theory, mathematical modeling of communication networks including admission control, radio resource management using artificial intelligence.

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