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Degree distributions in large networks:
A little theory and a counterexample

Prof. Armand M. Makowski
University of Maryland College Park, USA

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Venue: Room **G**6302, City University of Hong Kong
Reception starts at 2:45pm
(Language: **English**)

Abstract

In random graph models, the degree distribution of an individual node should be distinguished from the (empirical) degree distribution of the graph that records the fractions of nodes with given degree. We introduce a general framework to explore when these two degree distributions coincide asymptotically in a sequence of homogeneous random networks of increasingly large size. The discussion is carried under three basic statistical assumptions on the degree sequences: (i) distributional homogeneity; (ii) existence of an asymptotic (nodal) degree distribution; and (iii) asymptotic uncorrelatedness. It follows from the discussion that under (i)-(ii) the asymptotic equality of the two degree distributions occurs if and only if (iii) holds. We use this observation to show that the asymptotic equality may fail in some homogeneous random networks with the counterexample found in the class of random threshold graphs for which (i) and (ii) hold but where (iii) does not. An implication of this finding is that these random threshold graphs cannot be used as a substitute to the Barab´asi-Albert model for scale-free network modeling, as was proposed by some authors. The results can also be formulated for non-homogeneous models by making use of a random sampling procedure over the nodes.

This is joint work with former graduate student Siddarth Pal (UMD/ECE, now Raytheon/BBN)

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About the Speaker

Armand M. Makowski received the Licence en Sciences Mathematiques from the Universite Libre de Bruxelles in 1975, the M.S. degree in Engineering-Systems Science from U.C.L.A. in 1976 and the Ph.D. degree in Applied Mathematics from the University of Kentucky in 1981. In August 1981, he joined the faculty of the Electrical Engineering Department at the University of Maryland College Park, where he is Professor of Electrical and Computer Engineering. He has held a joint appointment with the Institute for Systems Research since its establishment in 1985.

Armand Makowski was a C.R.B. Fellow of the Belgian-American Educational Foundation (BAEF) for the academic year 1975-76; he is also a 1984 recipient of the NSF Presidential Young Investigator Award. He became an IEEE Fellow in 2006, and received a Lady Davis Trust Fellowship in Fall 2014.

His research interests lie in applying advanced methods from the theory of stochastic processes to the modeling, design and performance evaluation of engineering systems, with particular emphasis on communication systems and networks. This includes: Asymptotic methods for the performance evaluation of switching systems, long-range traffic modeling for multimedia applications in high-speed networks, many-flow asymptotics for TCP modeling, modeling locality of reference in caching systems, applications of swarm intelligence to networking, and resource allocation issues in wireless networks (e.g., handoffs and paging). His more recent work has focused on random graph modeling for random key pre-distribution in wireless sensor networks.