

# Mathematics Distinguished Lecture Series

## Department of Mathematics

### University of Kansas

## Stochastic Networks: Bottlenecks, Entrainment and Reflection

**Ruth J. Williams**

**Member of the National Academy of Sciences  
University of California, San Diego**

**Thursday, November 19, 2020**

**4:00 pm**

**Virtual reception at 3:45 pm**

**Zoom**

**<https://kansas.zoom.us/j/95720570916> (password: 799398)**

Stochastic models of complex networks with limited resources arise in a wide variety of applications in science and engineering, e.g., in manufacturing, transportation, telecommunications, computer systems, customer service facilities, and systems biology. Bottlenecks in such networks cause congestion, leading to queueing and delay. Sharing of resources can lead to entrainment effects. Understanding the dynamic behavior of such modern stochastic networks present challenging mathematical problems.

This talk will describe some recent developments and open problems in this area. A key feature will be dimension reduction, resulting from entrainment due to resource sharing. An example of bandwidth sharing in a data network will be featured.

For background reading, see the survey article: R. J. Williams, Stochastic Processing Networks, *Annu. Rev. Stat. Appl.* 2016. 3:323–45.

Ruth Williams holds the Charles Lee Powell Chair in Mathematics I at the University of California, San Diego (UCSD). She is a mathematician who works in probability theory, especially on stochastic processes and their applications. She is particularly known for her foundational work on reflecting diffusion processes in domains with corners, for co-development with Maury Bramson of a systematic approach to proving heavy traffic limit theorems for multiclass queueing networks, and for the development of fluid and diffusion approximations for the analysis and control of more general stochastic networks, including those described by measure-valued processes. Her current research includes the study of stochastic models of complex networks, for example, those arising in Internet congestion control and systems biology.



Williams is an Elected Member of the US National Academy of Sciences, an Elected Fellow of the American Academy of Arts and Sciences, an inaugural Fellow of the American Mathematical Society (AMS), a Fellow of the Institute for Operations Research and the Management Sciences (INFORMS), the American Association for the Advancement of Science (AAAS), the Society for Industrial and Applied Mathematics (SIAM) and the Institute of Mathematical Statistics (IMS). She is also a Fellow of St. Hilda's College at the University of Melbourne. Williams has been a Guggenheim Fellow, an Alfred P. Sloan Fellow and a National Science Foundation Presidential Young Investigator. In 2012, Williams served as President of the IMS. In 2016, Williams was awarded the John von Neumann Theory Prize by INFORMS, jointly with Martin I. Reiman. She was awarded the 2017 Award for the Advancement of Women in Operations Research and the Management Sciences. In 2018, Williams was elected as a Corresponding Member of the Australian Academy of Science. For her complete biography go to <https://www.math.ucsd.edu/~williams/bio.html>.