

# Research Seminar

Energy and Information Systems (EIS)



## Molecular Communication: Theoretical Limits and Experimental Implementations

**Nariman Farsad | Stanford University**

Thurs. May. 5th, 2016 | 12:30-1:30 PM | Porter Hall B34

### Seminar abstract:

Molecular communication is a new and bio-inspired field, where chemical signals are used to transfer information instead of electromagnetic or electrical signals. In this paradigm, the transmitter releases chemicals or molecules and encodes information on some property of these signals such as their timing or concentration. The signal then propagates through the medium between the transmitter and the receiver through different means such as diffusion, until it arrives at the receiver where the signal is detected and the information decoded. This new multidisciplinary field can be used for in-body communication, secrecy, networking microscale and nanoscale devices, infrastructure monitoring in smart cities and industrial complexes, as well as for underwater communications. Since these systems are fundamentally different from telecommunication systems, most techniques that have been developed over the past few decades to advance radio technology cannot be applied to them directly.

In this talk, we first explore some of the fundamental limits of molecular communication channels. In particular, we explore the fundamental capacity limits of the molecular timing channels, where information is encoded in the time of release of chemical signals. We also evaluate how capacity scales with respect to the number of particles released by the transmitter. Then, optimal detection in molecular timing channels is briefly discussed. We conclude the talk by presenting some of the recent experimental implementations of molecular communication systems.

### Speaker Bio:

Nariman Farsad received his M.Sc. and Ph.D. degrees in computer science and engineering from York University, Toronto, Canada in 2010 and 2015, respectively. He is currently a Postdoctoral Fellow with the Department of Electrical Engineering at Stanford University, where he is a recipient of Natural Sciences and Engineering Research Council of Canada (NSERC) Postdoctoral Fellowship. Nariman has won the second prize in 2014 IEEE ComSoc Student Competition: Communications Technology Changing the World, the best demo award at INFOCOM'2015, and was recognized as a finalist for the 2014 Bell Labs Prize. He has been an Area Associate Editor for IEEE Journal of Selected Areas of Communication--Special Issue on Emerging Technologies in Communications, and a Technical Reviewer for a number of journals including IEEE Transactions on Signal Processing, and IEEE Transactions on Information Theory. He was also a member of the Technical Program Committees for the ICC'2015, BICT'2015, GLOBECOM'2015, and GLOBECOM'2016.

Energy and Information  
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*Seminar notes: Refreshments will be served*