Emina Soljanin
Distinguished Professor, ECE Department, Rutgers University

Mrs. Urmila Agrawal IISc Distinguished Visiting Chair Professorship
Report on the visit to IISc ECE in August of 2024

_____

I express my sincere gratitude for the Mrs. Urmila Agrawal Chaired Professorship Award. It was a great honor to receive the award and to visit the place I consider India's very best in my research area of classical and quantum communications, information, and coding theory. On a more personal level, I appreciate the nature of this award, established by a successful person to honor his mother by recognizing and providing opportunities for senior women scientists.

I thank my hosts professors Navin Kashyap and Parimal Parag and the EECS Division Dean Rajesh Sundaresan for their hospitality, and the staff of the Centre for Networked Intelligence for their assistance. Preetam Patil took care of my computing needs, and Thejashwini G. helped me almost daily in various ways.

<u>Visit Dynamics</u>

My visit started in early August 2024, coinciding with the beginning of the Fall semester. There was a lot of energy and excitement among students and faculty as the term started. I have previously known several faculty members and was looking forward to learning more about their work and exploring possible collaborations. I have, in particular, interacted with ECE professors Navin Kashyap, P. Vijay Kumar, and Parimal Parag; ESE professor Shayan Garani; and a visiting professor and IISc alumna, Lalitha Vadlamani. I met many other colleagues at an ECE beginning-of-semester social event during the first week of my visit.

Professors Kashyap and Garani jointly taught a quantum computing course, which sparked intense interest among students and postdocs. We discussed, then started a reading group on specific directions in quantum error correction. Quantum error correction is essential for implementing quantum devices and also poses fundamental theoretical problems. Students, postdocs, professors, and research visitors actively participated in this reading group. It continues to run even now.

I gave my first talk at the Centre for Networked Intelligence (CNI) in the second week of my visit. (The seminar series has a webpage hosted at https://cni.iisc.ac.in/seminars/.) The talk titled "Codes for (Un)Expected Loads" was targeted at the general ECE audience. It addressed distributed systems with highly fluctuating access patterns and volumes, such as Edge computing.

I gave an institute-wide talk in the last week of my visit. The talk titled "On Some Quantum Internet Information Rates" was a general audience talk. Over the last weekend of my visit, I participated in a coding theory workshop at IIT-B with my host, Professor Kashyap. The event provided an opportunity to further connect with coding theorists from different universities and academic departments in India.

Collaborations and Interactions

I had discussions with four IISc professors and their research groups. With Professor Kashyap, we discussed several problems in classical and quantum error correction. With Professor Vijay Kumar, we discussed quantum continuous variable coding and several issues in 6G wireless. With Professor Parag, we discussed emerging networking. With Professor Garani, we discussed various aspects of classical and quantum communications.

I had a particularly fruitful interaction with the visiting professor and IISc alumna, Lalitha Vadlamani. In particular, we began a collaboration on a topic from my first IISc talk. We continued to work with one of my PhD students after my visit. Professor Vadlamani visited me in June of 2025. This collaboration resulted in a publication that we presented at the flagship conference in our field (see below). A journal version of this paper is under review. Lalitha and I also had many discussions on quantum computing. Together, we visited IISc's Prof. Vibhor Singh's lab (of their qubit setup) and his postdoc, K. Shantha Ram gave us a tour.

Students and postdocs from the groups I mentioned above often stopped by my office for technical discussions and friendly chats. I particularly enjoyed talking with Janaky Murthy when she interviewed me for the CNI newsletter.

During my second visit, my goal is to deepen and broaden the collaborations we have started, particularly in coding for emerging classical and quantum systems.
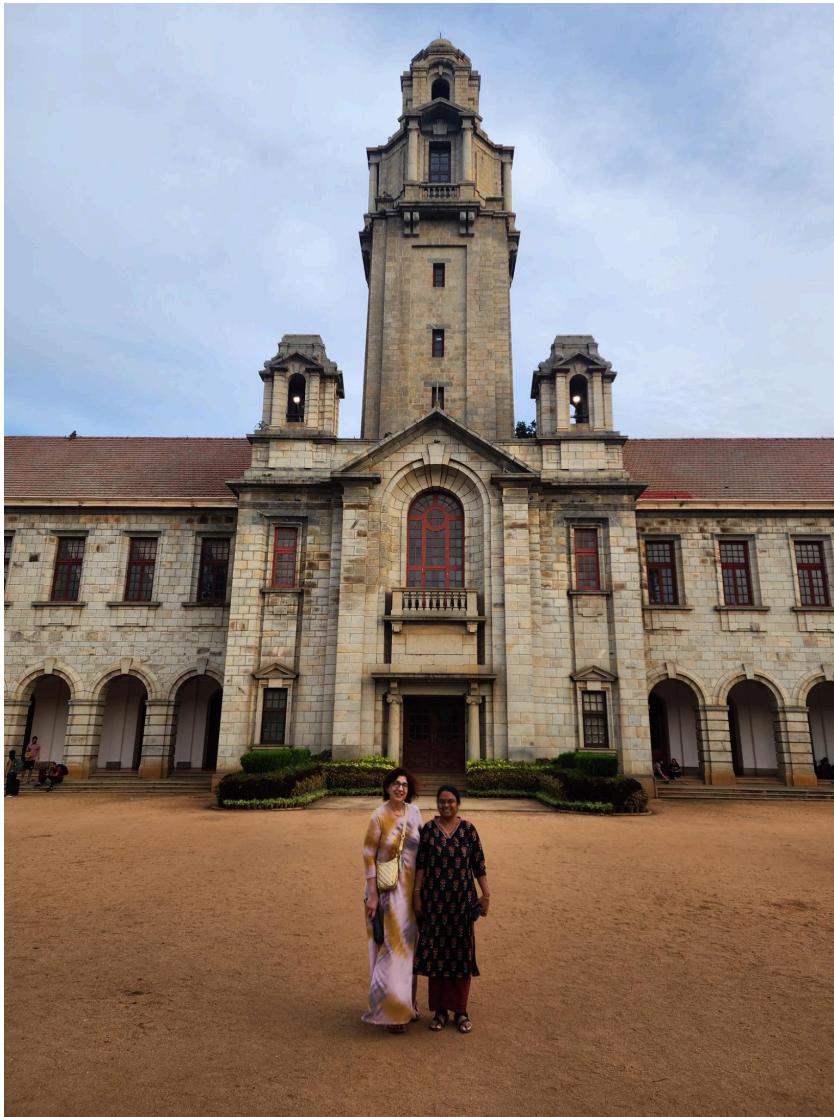
Papers
Hoang Ly, Emina Soljanin, V. Lalitha
On the Service Rate Region of Reed-Muller Codes
2025 IEEE International Symposium on Information Theory (ISIT 2025)
See arXiv preprint arXiv:2501.13105 for the journal version under review

Professors Emina Soljanin and Lalitha Vadlamani.