Energy efficient 5G/6G MISO-NOMA schemes

Company: Nokia Bell Labs France (Paris-Saclay) [https://www.bell-labs.com]
Department: Mathematics of Dynamic Systems, Route de Villejust, Nozay 91620, France
Lab of Information, Networking & Communication Sciences, 75013 Paris (www.lincs.fr)
Supervisors: Calvin C. S. Chen, Research Scientist (MTS), chung_shue.chen@nokia-bell-labs.com
Lou Salaün, Research Engineer, lou.salaun@nokia-bell-labs.com
Albert C. W. Sung, Professor (City Univ. of Hong Kong), albert.sung@cityu.edu.hk

Context

The dramatically increased demand of data traffic and the prevalence of intelligent applications, e.g., augmented reality (AR), intelligent computing, internet-of-things (IoT), have imposed great challenges for the future wireless communication networks (5G/6G) in providing massive connectivity with satisfied user’s quality of service. The concept of multiple-input single-output (MISO) non-orthogonal multiple access (NOMA) was initially proposed in [1], which has attracted considerable attentions since then. Several papers have studied energy efficiency and power minimization problems of such MISO-NOMA systems in the literature. In [2], a joint beamforming and power allocation Gauss-Seidel algorithm for a two-user MISO-NOMA system is proposed to minimize total transmit power. The minimum power and the optimal precoding vector of the two-user MISO-NOMA system are obtained through Newton’s iterative algorithm in [3]. The authors of [4] investigate the power minimization problem for a two-cell MISO-NOMA system. Nevertheless, power minimization for general multi-cell MISO-NOMA systems is highly favorable for energy-efficient 5G/6G systems and remains an open problem.

Objective

The objective of this project is to study energy efficiency and power minimization problem for 5G/6G multi-cell MISO-NOMA systems. The student will first study previous algorithms developed in the team, then extend them to multi-cell distributed environment. He/she will also have access to a simulation framework developed in Matlab and Python. Therefore, intermediate level in programming is required. Basic understanding of MIMO, MISO and NOMA is a definite plus. The student will work in a strong team of international research collaboration and finalize its training by describing the work in a technical report. It is the objective to submit suitable technical contributions as 5G/6G proposals and to summarize the most relevant results in a research paper, which can be submitted to a distinguished research conference or journal. It can also be considered as a preliminary work for a PhD program.

Tasks

- Analyze energy efficiency problems in MISO-NOMA systems of multiple cells
- Design user-grouping, beamforming and power allocation schemes
- Implement new and existing algorithms (e.g., in Matlab or Python) based on our existing software framework
- Performance simulations and evaluation and interact in our project team

Criteria skills
• Programming: intermediate level in Matlab, Python or similar
• Basic knowledge of multiple access schemes (e.g. OFDMA, NOMA, MIMO, MISO, etc.)
• Interests in mathematical optimization and distributed algorithms and is a definite plus
• Language: fluent English, we are in a multi-culture multi-language work environment

References


