PhD project: Power Procurement of Cellular Wireless Networks Under Uncertain Renewable Power Generation

You want to apply your data science knowledge to the basic research questions and societal challenges of our modern world? Our scientists in HDS-LEE address some of the most pressing issues of our time, such as energy transition, climate change and resource scarcity, brain function, drug design, identification of diseases at very early stages.

As Helmholtz School for Data Science in Life, Earth and Energy (HDS-LEE), we aim to educate and train the next generation of data scientists during their doctoral thesis in close contact to domain-specific knowledge and research in three application domains: Life and medical science, earth science, energy systems and material science. Visit HDS-LEE at: https://www.hds-lee.de/

Project overview

Mobile Traffic has grown rapidly due to the emergence of various mobile applications.

This makes communication systems to be one of the biggest power consumers. A consequence of the high energy demand is the increase of carbon dioxide (CO_2) emission, which negatively affects the environment. The emergence of smart grids (SGs) enables the use of developed information technologies through which the power is efficiently delivered to the consumers. In addition to the conventional electrical grid, SG allows the massive integration of intermittent renewable energy sources such as wind and solar in the procurement cycle.
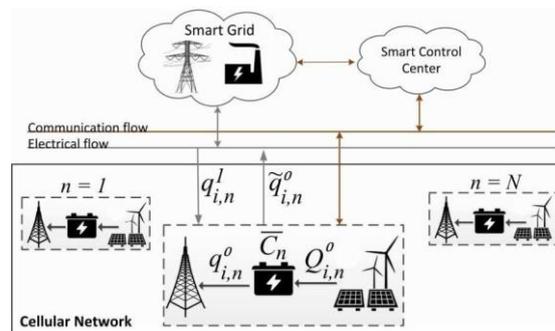
Therefore, the scope of the Ph.D. is to develop an optimized power procurement approach of cellular systems under uncertainties in renewable energy power generation. The output of the approach is to determine the optimal amount of power procured from the external and internal retailers and the amount of power to be sold to the grid at each time of the cycle and for each base station in the cellular system.

Your job

- Model the energy system and formulate the constrained optimization problem aiming to minimize the procurement costs.
- Formulate the stochastic optimal control problem.
- Derive and numerically solve the associated Hamilton-Jacobi-Bellman equation.
- Compare the algorithm's performance to previous approaches.

Your profile

- Master's degree in mathematics or a relevant discipline.
- Expert knowledge of at least one programming language.
- Expertise in numerical analysis, stochastic calculus, and stochastic optimal control.
- Excellent organizational skills and the ability to work independently.
- Excellent communication skills and ability to work as part of a team in an international and interdisciplinary environment.
- Excellent communication skills in English are mandatory: TOEFL or equivalent evidence of English-speaking skills.
- Language skills in German are not required.
- A high level of scholarship as indicated, for example, by bachelor and master study transcripts and two reference letters.

Our offer

The PhD project will be located at the RWTH Aachen University in the group "Mathematics of Uncertainty Quantification". You will be jointly supervised by Raul Tempone. We offer ideal conditions for you to complete your doctoral degree:

- Outstanding scientific and technical infrastructure
- A highly motivated group as well as an international and interdisciplinary working environment
- Continuous scientific mentoring by your scientific advisors
- Chance of participating in (international) conferences
- Unique HDS-LEE graduate school program
- Qualification that is highly welcome in industry
- Further development of your personal strengths, e.g., via a comprehensive further training program
- Targeted services for international employees, e.g. through our International Advisory Service

We offer you an exciting and varied role in an international and interdisciplinary working environment. The position is for a fixed term of 3 years. Your salary is in line with 100 % of pay group 13 of the Collective Agreement for the Public Service (TV-L).

RWTH Aachen University is certified as a "Family-Friendly University". We particularly welcome and encourage applications from women, disabled persons and ethnic minority groups, recognizing they are underrepresented across RWTH Aachen University. The principles of fair and open competition apply and appointments will be made on merit.

Apply to and contact for further information: Prof. Raul Tempone tempone@uq.rwth-aachen.de and
Dr. Nadhir Ben Rached benrached@uq.rwth-aachen.de

Starting date: at the next possible date