

# Advanced methods for modelling and intelligent control of commercial buildings

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## Summary

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*Commercial buildings are among the main consumers of electrical and heating energy and traditional building automation solutions are nowadays not sufficient for efficient control. At the same time a lot of data can be obtained via BMS and IoT solutions. The research in the framework of this PhD project will be devoted towards data-driven methods and novel solutions for modelling and prediction of behavior buildings' technical systems aiming development of energy efficient building automation solutions.*

Research field:	Information and communication technology
Supervisors:	Prof. Dr. Eduard Petlenkov Prof. Dr. Juri Belikov
Availability:	This position is available.
Offered by:	School of Information Technologies Department of Software Science
Application deadline:	Applications are accepted between June 01, 2022 00:00 and June 30, 2022 23:59 (Europe/Zurich)

## Description

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The proposed PhD project will focus on the development of novel intelligent control strategies for commercial real estate, with an emphasis on energy efficiency and environmental sustainability. The project is based on the premise that modern building management systems have reached an unmanageable level of complexity which cannot be simply handled by a human operator. In addition, the technology has reached a certain level of efficiency, and its further potential can be realized through optimal resource utilization and intelligent control.

There is a clear need for the development of scalable data-driven solutions that, when combined with recent advancements in the IoT domain, make extensive use of available internal (electricity, heat consumption, CO2 level, etc.) and external data (weather, electricity prices, etc.). The developed models and algorithms should help the building operators make informed decisions. The major part of the project will be devoted to the study of the most common building's techno systems. Such generality allows the potential PhD student to work on various theoretical and practical problems, including decision-making, optimization, or controller design, with an emphasis on energy efficiency. Some of the possible research questions are as follows:

- What are the best methods for designing intelligent control methods for building's techno systems?
- How to bridge the gap in technology transfer between academy and building automation systems?
- How to develop future-proof algorithms for optimal control of building's techno systems, renewable energy, and charging stations?

The PhD candidate is expected to contribute to theoretical aspects as well as to practical aspects such as running simulations, planning experiments, and supervision of students. More detailed tasks can be agreed based on the knowledge and experience of the potential PhD candidate.

It is assumed that the PhD candidate is familiar with the basic definitions and concepts used in control theory and has some basic knowledge of building automation systems.

### Supervisors:

Main supervisor: Prof. Dr. Juri Belikov  
Co-supervisor: Prof. Dr. Eduard Petlenkov

### Qualifications:

Master's degree in mathematical control theory, systems and control, applied mathematics or related fields.



**The applicants should fulfil the following requirements:**

- Strong background in control theory;
- Knowledge of building's techno systems;
- Strong knowledge of Python;
- Previous experience with data analysis and machine learning algorithms;
- Excellent communication skills in oral and written English language;
- Previous research experience.



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