

Master/Bachelor Thesis

Topic: Exploring Novel AI Methods for Analog and Mixed-Signal Circuit Design

Description: Designing Analog and Mixed-Signal (AMS) circuits is an important but challenging part of modern electronics. It often requires many simulations and repeated adjustments to achieve the desired performance, making the design process time-consuming. Recent advances in Artificial Intelligence (AI) provide new opportunities to make this process faster and more efficient. This thesis explores how modern AI methods can support AMS circuit design, with a particular focus on learning from circuit structures, design data, and fundamental knowledge of circuit behavior. Graph-based learning methods will be investigated to understand the relationships between circuit components and their connections, while physics-aware AI approaches will be explored to improve the reliability and usefulness of the learned models. As a practical extension, these approaches can be applied to biomedical electronics, where AMS circuits are used to acquire and process biological signals such as ECG, EEG, or EMG. For example, AI-assisted design could support the development of circuits for extracting meaningful information from weak and noisy biomedical signals. The overall goal is to explore how AI can contribute to faster, more reliable, and application-oriented AMS circuit design.

Content:

- Literature review on the state-of-the-art AI methods for Analog and Mixed-Signal (AMS) circuit design
- Familiarization with AMS circuit design, simulation, and available design workflows
- Development and evaluation of graph-based/knowledge-based/physics-based learning methods for AMS circuit analysis and design
- Application of the developed methods to selected biomedical electronics use case, such as ECG, EEG, or EMG signal acquisition

Requirements / Prerequisites:

- Studies in the field of electrical engineering, electronics, computer engineering, or a comparable field
- Basic knowledge of electronic circuits and circuit simulation
- Interest in Artificial Intelligence, Machine Learning, and their application to electronic circuit design
- Basic programming skills (e.g., Python) are helpful

Thesis character: 50% practical / 50% theory

Language of Instruction: English

Start date: By Agreement

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