Professur für Regenerative Energiesysteme
Campus Straubing für Biotechnologie und Nachhaltigkeit
Technische Universität München

Bachelor Thesis / Master Thesis:

Mathematical Modeling of Biogas Plants

Are you fascinated by the intricate interplay of mathematics, chemistry, and process engineering? Are you eager to explore the optimization of biogas plant operations through advanced modeling techniques, including differential equations? We invite you on a Bachelor/Master thesis journey focusing on the mathematical modeling of biogas plants, offering a unique opportunity to delve into sustainable energy.

Project Description:

In this thesis, you will delve into the diverse landscape of mathematical models for biogas plants to identify and refine the most optimal model for real-world applications. The project unfolds in several key phases:

1. **Literature Review and Model Comparison:** You will commence your journey by immersing yourself in a comprehensive review of existing literature on the mathematical modeling of biogas plants. Through this process, you will gain insights into various modeling approaches, assessing them based on complexity, accuracy, and controllability, with a keen understanding of the role of differential equations.
2. **Practicability Assessment:** One crucial aspect of the evaluation will be the practicability of implementing these models in real-world scenarios. You will explore the challenges associated with measuring essential parameters in the laboratory, considering factors such as time, cost, and expertise required for sample transportation and analysis.
3. **Exploration of Real-Time Parameter Estimation:** Recognizing the limitations of traditional laboratory-based measurements, you will embark on a quest to investigate alternative methods for real-time parameter estimation. This may involve leveraging innovative technologies such as Near-Infrared (NIR) sensors combined with machine learning algorithms to estimate parameters in real-time.
4. **Model Selection or Creation:** Armed with a deep understanding of existing models and emerging technologies, you will make informed decisions regarding selecting or creating an optimal mathematical model for biogas plant operations, with a strong emphasis on differential equations. If necessary, you will develop a novel model that addresses the shortcomings of existing approaches, ensuring that all required parameters can be measured or estimated in real-time.

Key Requirements:

- Strong background in chemistry, mathematics, and understanding of differential equations.
- Excellent analytical and problem-solving skills.
- Self-motivated and capable of working independently.

Start date: 1 April 2024.

Contact:

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