Chair of Renewable and Sustainable Energy Systems
Department of Electrical and Computer Engineering
Technical University of Munich

Master's Thesis

Optimal control of plant growth conditions

Background

Vertical farming has emerged during the last decade as a way to grow food in a completely controlled environment. Indoor farming in stacked layers allows for very low water and significantly lower fertilizer demand compared to conventional farming in the open field. It enables multiple harvests throughout the year and therefore a much higher yield. The big challenge is to decrease the very high energy demand for lighting and air conditioning.

Goals

The goal of the thesis is to develop an optimal control method that is able to minimize the energy demand of a vertical farming system while at the same time maximizing the yield. This method should consider interactions between plants and their environment [1] (plant energy balance model) and also incorporate a plant growth model [2]. The following tasks are included:

- Literature review on the plant models and vertical farming
- Selecting the appropriate plant models and collecting the required data (parameters)
- Developing the concept of optimal control for plant growth conditions
- Implementing the developed concept
- Evaluating the model on an appropriate test system

Requirements

- Interest in vertical/indoor farming
- Programming skills: MATLAB or Python
- Knowledge of numerical optimization and optimal control
- CV and current grade report

Contact

Smajil Halilovic, M.Sc.
Lichtenbergstr. 4a, 85748 Garching b. München, Raum 2016
E-Mail smajil.halilovic@tum.de

[1] L. Graamans, A. van den Dobbelsteen, E. Meinen, and C. Stanghellini, "Plant factories; crop transpiration and energy balance", *Agricultural Systems*, vol. 153, pp. 138-147, 2017.

[2] E. Van Henten, "Validation of a dynamic lettuce growth model for greenhouse climate control", *Agricultural Systems*, vol. 45, no. 1, pp. 55-72, 1994.