

# Optimal and robust control problems of microalgae cultivation

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The potential of microalgae as a source of biofuels, CO<sub>2</sub> capture, and biomass-derived cosmetic and pharmaceutical products has pushed intense academic and industrial research. Microalgae cultivation in open and closed photobioreactor systems requires control to keep the operation at optimum conditions. Challenging and crucial issues include enhancing microalgae growth for CO<sub>2</sub> capture and improving lipid accumulation for biofuel production. The microalgae consist of a complex network of biochemical reactions of different species, such as sugars, proteins, carbohydrates, and lipids. Biomass growth is also susceptible to external disturbances, such as nutrient and CO<sub>2</sub> inputs and light fluctuations. Furthermore, the microalgae may compete with other microorganisms for their food, limiting the microalgae growth. This work summarizes different optimization and control problems involved in microalgae cultivation, including ecological interactions and the photobioreactor operation aimed at biofuel production and CO<sub>2</sub> capture tasks.

Keywords: Microalgae cultivation, biofuel production, CO<sub>2</sub> capture, multivariable control.