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Robust observation strategy to estimate the substrate concentration in the influent of a fermentative bioreactor for hydrogen production

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Abstract

The observation strategy developed in this article consists in an H_∞ Luenberger observer coupled to a classical super-twisting observer. The H_∞ Luenberger observer uses the biohydrogen flow rate measured at the reactor output to estimate the glucose and the biomass concentrations inside the reactor. These estimations are taken by the super-twisting observer to estimate the glucose concentration at the reactor input. First, pseudo-stoichiometric and kinetic parameters of the bioreactor model are identified. Two semi-definite optimization problems are then proposed to compute the observer gains. Results show that the biomass is a sensitive state variable. In spite of this, the glucose estimated at the reactor input correctly follows the experimental data and the estimation error remains close to zero in the complete period of time considered.

Keywords: Biohydrogen production, robust estimation, super-twisting observer, Luenberger observer, H_∞ control.

1. Introduction

The monitoring of processes is a key subject in biotechnological engineering due to the importance of following the state of a set of critical variables. The information obtained from

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