

Model-Based Identification and Control on Baker's Yeast Fed-Batch Fermentation

E.C. Ferreira¹, F. Oliveira², P. Pimenta³ and S. Feyo de Azevedo^{3*}

¹Universidade do Minho, Engenharia Biológica, Largo do Paço, 4700 Braga PORTUGAL

²Universidade do Minho, Electrónica Industrial, Largo do Paço, 4700 Braga PORTUGAL

³Departamento de Engenharia Química, Faculdade de Engenharia da Universidade do Porto
Rua dos Bragas, 4099 Porto Codex, PORTUGAL

A theoretical and experimental study is reported concerning the control of baker's yeast fed-batch fermentation. The overall approach follows the methodology proposed by Bastin & Dochain (1990) which exploits the structure of a general non-linear deterministic model for bioreactors. Software-sensors have been developed and employed for the on-line estimation of 'non-measured' state variables (Feyo de Azevedo *et al.*, 1992). An adaptive linearizing control scheme, based as well on the general model structure, utilises the observed state to compute the control action.

The strategy was tested theoretically through a 'real-time process simulator' (Pimenta & Feyo de Azevedo, 1993) acting as the baker's yeast fermentation, linked to a 'control computer' via serial RS232C communications. Experimental work was carried out in parallel in a 5 litre laboratory rig (B. Braun Biostat MD5) locally controlled by a 'digital control unit' and supervised by a control computer.

The main results to be reported address the overall performance of the control scheme, particularly in what concerns its sensitivity to model uncertainty, the noises in measurements and to slow and fast changing process parameters. As well it is relevant to emphasise that the 'process simulator' employed has proved to be an important tool for studies on process control and for experiment planning.

Bastin, G. and Dochain, D. "On-line Estimation and Adaptive Control of Bioreactors", Elsevier Science Publishers, Amsterdam, 1990.

Feyo de Azevedo, S.; Pimenta, P.; Oliveira, F. and E.C. Ferreira, Proc. of 5th Int. Conf. Computer Appl. in Fermentation Technol. and 2nd IFAC Symp. on Modeling and Control of Biotechnical Processes, (in press) 1992.

Pimenta, P. and Feyo de Azevedo, S., 'A Real-time Process Simulator for Non-linear MIMO Systems', European Symposium on Computer Aided Process Engineering 2, Computers and Chem. Engng., 17 suppl., pp. S343-348, 1993