in a SEARLE VT550 viscometer using a bob and cup geometry. To build the mathematical law, general tests following the International Office of Cocoa, Chocolate and Sugar Confectionery (IOCCC) recommended method (Servais et al., 2004) were performed. The obtained rheogram shows that the chocolate has a slightly thixotropic behavior. More focus is set on a smaller range of shear rate important for the industrial application (Debaste et al., 2008). Measures for various temperatures and various quantities of cocoa butter were realized. The results show a classical shear-thinning behavior. Further, a statistical analysis of the results was made to determine the parameters of a power-law describing this behavior. It appears that temperature and cocoa butter fraction have no influence on the exponent but well on the consistency parameter. For margarine, the goal is to model the flow in resting tubes, the last step in the industrial production (Herman et al., 2008). To determine the rheological behavior of the margarine two kinds of devices were used. First the SEARLE VT550 viscometer with a four blades impeller was used. And the results were not satisfying because the measured viscosity was often nulls. We suppose that the sample was broken into two blocks, one between the blades of the impeller and a second outside of the impeller. A HAAK MARS rheometer with a plate-plate geometry was also used. In both experiments we evaluate how a change of 1°C can affect the viscosity of margarine. The obtained flow curves show that the margarine has a plastic and thixotropic behavior and that a variation of 1°C affects margarine's rheology. With the chocolate rheological law, the perspective is to get a general model for concentrated suspensions. And for margarine, more measures with an adapted viscometer should be done to build a model.

Keywords. Rheology, thixotropy, chocolate, margarine.

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Monitoring and robust adaptive control of fed-batch cultures of microorganisms exhibiting overflow metabolism

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Overflow metabolism characterizes cells strains that are likely to produce inhibiting by-products resulting from an excess of substrate feeding and a saturated respiratory capacity. The critical substrate level separating the two different metabolic pathways is generally not well defined. Monitoring of this kind of cultures, going from model identification to state estimation, is first discussed. Then, a review of control techniques which all aim at maximizing the cell productivity of fed-batch fermentations is presented. Two main adaptive control strategies, one using an estimation of the critical substrate level as set-point and another regulating the by-product concentration, are proposed. Finally, experimental investigations of an adaptive RST control scheme using the observer polynomial for the regulation of the ethanol concentration in *Saccharomyces cerevisiae* fed-batch cultures ranging from laboratory to industrial scales, are also presented.

Keywords. Bioreactor, control system and optimization, overflow, on-line fed-batch.