

# Popular science article

## Control and properties of processes with recycle dynamics

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This master thesis discusses the effects of recycle streams on the process dynamics and in the achievable control performance. For economical and environmental reasons recycle streams are very common in chemical plants. They allow to save material and energy but create an interaction between the different parts of the plant which makes the processes in the plant harder to control.

The questions addressed are: can the current industry standard tuning methods still be applied to systems with recycle, and if not, how can they be modified? This is approached by analysing one of the most common processes in industry (integrating process) using a PI controller with and without recycle. The controller is tuned according to the arrest time tuning method, the most extended method for this kind of process.

The thesis starts with an analysis of the case without recycle in which it is shown the typical performance using arrest time tuning. The purpose of this analysis is to act as a point of reference for the case in which the process is affected by recycle.

The next step is to analyze the integrating process with recycle. The results show that the integrating model doesn't capture all the dynamics of the integrating process with recycle and in some cases, when the recycle dynamics are ignored in the tuning method, can lead to instability. Consequently a new model, and an easy tuning method for the industry standard controllers, is proposed.

The model that gives a better relation between accuracy and simplicity is the "IPZ model" with the tuning method recommended by D.Nelson and

T.Gardner. The authors suggest a robust tuning method for the IPZ process. This process is very similar to the case with recycle analyzed in this project. For this reason the "IPZ tuning method" gives a very robust performance and a better approximation when it is applied to the integrating process with recycle.