Dynamic Models in process control through the centuries

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Mathematical modeling of dynamic systems is a research topic still open in process control due to the complexity of real processes, the interaction between components, uncertainties in measurements and parameters, among other aspects. Research in this area is being developed exponentially since mid-1950s and increasingly more with the development of computers and artificial intelligence and computation and numerical solutions strategies.

This work explores the evolution of the development of dynamic models aimed to firstly understand the world around us, and nowadays to control a process system. Initially some definitions are stated. System definition and process automation are addressed from the point of view of automatic control. Some examples of ancient history and middle-age models are then presented. Enlightenment is discussed in more detail due to the classical mechanics birth with Newton's first law and the economic, social and technological transformation that followed afterwards with industrial revolution.

Chemical and process engineering models research is explored from the existing tools and motivation point of view. Tools available in modern engineering used to find system models that are as perfect and useful as possible, are presented. Some problems found nowadays in modeling are given, such as: the differences in the results obtained with different models of the same system, the uncertainty in the measurement and the difficulty in the model mathematical solution. The work concludes by presenting a classification of the types of models and a methodology proposed within the Kalman research group of dynamic processes for the generation of models. All this is explained with some examples of research work developed at the chemical engineering program of Universidad Nacional de Colombia- Sede Medellin.

Keywords: Dynamic process modeling, Phenomenological based semi-physical model, Dynamic modeling history.