Modelling and Simulation in Economy

Andreas Körner[1], Stefanie Winkler[2]
[1]Institute for Analysis and Scientific Computing, Wiedner Hauptstraße 8-10, 1040 Wien, Vienna University of Technology
[2]Institute for Analysis and Scientific Computing, Wiedner Hauptstraße 8-10, 1040 Wien, Vienna University of Technology
andreas.koerner@tuwien.ac.at, stefanie.winkler@tuwien.ac.at

Abstract
This article presents the application of mathematical modelling and simulation in economy. Simple static formulas can be replaced by dynamical models for simulating a certain behavior. The simulation results are useful to analyse a potential outcome and provide a forecast of the business process. This forecasts can be used to support decision-makers with scientific valid statements.

Keywords: Modelling, Simulation, static formula, dynamic model, black box modelling, white box modelling, forecasting, decision making

Introduction

Modelling and Simulation is not a field of science for itself, but is present in several fields of interest. The origin of the discipline of simulation is located in the circuit simulation environments of electrical engineers and digital electronically circuits. Several decades the simulation tools developed a certain level and are present in too many fields of interests.
Modelling theory by itself started in the surrounding of natural science because of the need to finding formulas which describe a certain process or behavior. This is called white-box modelling. Because of the increasing amount of data the modelling approach enlarged to offer methods for representing behavior of a system. This is called black-box modelling. Both approaches include a dynamical model and no static formula

2. Dynamic Models

Important is the difference between a dynamical model and a static formula. The difference is the usage of a mathematical description. A static formula is using a function f, which has an input list several variables and inputs $x_1,\ldots x_{,n}$ and the output y is given by

$$y=f(x_1,\ldots x_n).$$

A mathematical model is defined via a feedback in the description of a dynamic system. Figure 1 illustrates the basic principle of a system model and the corresponding dynamic system, which represents a mathematical model.

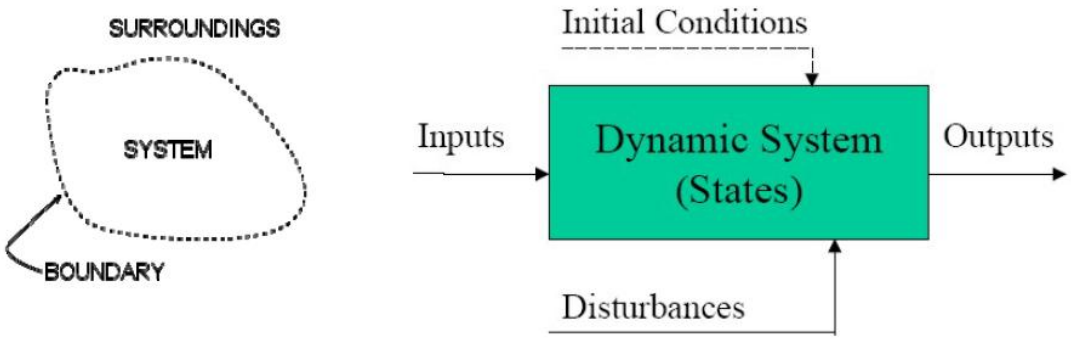

Figure. 1. Dynamic System Representation for Modelling a certain System Behavior

For illustration we consider the following example. Potential customers are the input for a certain company with the related benefit as output. A static approach would be to assume, that the benefit is proportional to the potential customers. This can be represented via a simple static formula. But the model is too simple for a real application. Including a more complex function, which has inputs and as well parameters, the input and the output by itself, so the model is developed to be dynamic. The model respects a more realistic scenario and is able to fit to much more case studies than the static formula is able to. Figure 2 illustrates this example.

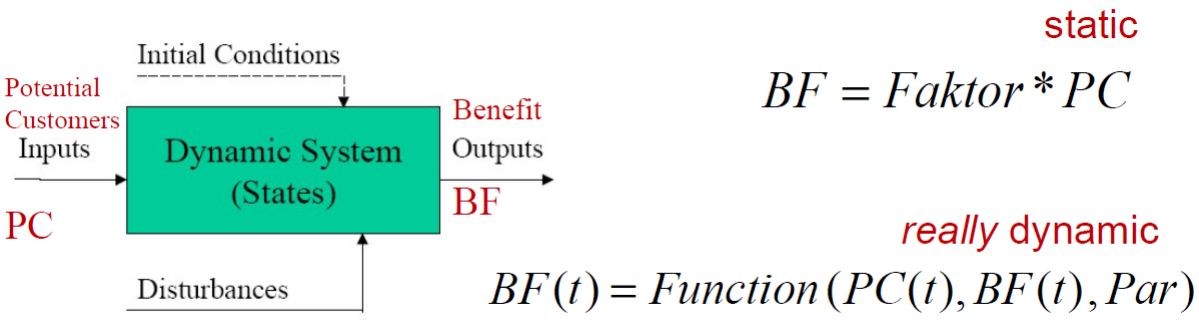

Figure. 2. Example of a Customer – Benefit relation of a Company.

3. Use and Application

The modelling theory provides through the dynamic system modelling a tool which can be used for forecasting. If a certain strategy for a company has to be chosen the policy maker and decision-maker can simulate a certain strategy by using the mathematical model. For this purpose the simulation results can be analyzed and can help decide which strategy can be applied.

References

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Andreas KÖRNER. He passed his bachelor study in electrical engineering in 2007 and his master study in telecommunications in 2009. Furthermore he studied the diploma study technical mathematics and finished this in 2012. Currently he is in front of defending his PhD thesis in the field of mathematical modelling about the mathematical characterisation of state events in hybrid modelling

His fields of activity include system theory, hybrid and state event modelling, numerical aspects of simulation, system simulation and applied mathematics in engineering. Since 2009 he is assistant professor in the research group of Mathematical Modelling and Simulation at the Institute for Analysis and Scientific Computing at Vienna University of Technology.