

## Project description

### COMPENSATING A SUDDEN CHANGE IN DEMAND

*Student:*

*Student ID:*

*Lecture:* MATH2130 “Ordinary Differential Equations”

*Lecturer:* Dr. Bernd Sing

*Submission date:* Noon, Monday 12<sup>th</sup> April 2010

*Maximal mark:* 20% of the final mark

*Marking scheme:* Contents (depth, breadth, accuracy): 50%

Initiative & Understanding: 20 %

Presentation of written report: 15 %

Use of literature: 15%

*Project description:*

### **Compensating a sudden change in demand**

A simple model that relates production  $P(t)$  and the demand  $E(t)$  is that the production change is proportional to the difference between production and demand, i.e.,

$$\frac{dP(t)}{dt} = -\alpha \cdot (P(t) - E(t))$$

where  $\alpha$  is a positive constant. So, production increases when demand exceeds production and decreases when production exceeds demand. We also assume that demand is proportional to production, i.e.,  $E(t) = (1 - L) \cdot P(t)$  where the constant  $L$  represents leakage of income from the system. However, we additionally assume that a sudden change takes place, e.g., due to some foreign protective measure the product cannot sold abroad anymore or due some terrorist activity not as many tourists are visiting the country anymore. Such a spontaneous drop in demand causes the production to approach a value less than without this drop. One way to stabilize this situation and achieve the initial production is by creating a policy

demand term, and we assume that the rate of change of this policy is proportional to the sum of itself and terms reflecting the current and total production (so that this “artificial” demand is increased a lot if production is down, a loss is made and the this additional demand is still low).

The student should familiarise herself/himself with this situation and comment on it. She/he then should discuss how to solve differential equation one gets here, and explain the term “*equilibrium value*”. As a starting point, this example can be found in Section 3.5 in R. McCann, “Introduction to Ordinary Differential Equations”, Harcourt Brace Jovanovich, 1982 (library: QA 372 M415), where also the article by A.W. Phillips, “Stabilization policy in a closed economy”, *Economics Journal* **64** (1954): 290–323, is cited.

The final report should be between 3–5 pages long (but must not exceed 8 pages) in normal font and single spaced (preferably as pdf). The target audience of the report are your fellow students in MATH2130. Appropriate literature (library!) should be used and cited. However, plagiarism will not be tolerated.

*Signature Student:*