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ON A MODIFICATION OF THE MODEL OF PHILLIPS FOR STABILIZATION CONTROL AND ADEQUATE INTERVENTION OF THE AUTHORIZED BODY OVERSEEING THE IMPLEMENTATION OF THE PROJECTS OF THE OPERATIONAL PROGRAMME

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The hereby article has been viewed the possibility of adapting the classical model of Phillips for stabilization control and adequate intervention of authorized bodies – Observation Committees of Operational Programmes (OPs). Proposals are: software tools for adaptive e-learning, as well as specialized module in *CAS MATHEMATICA*.

1. Introduction

Detailed description and justification of the classical model of Phillips for stabilization in a closed economy can be found in [1], [2], [3], [4].

Here we will focus on an adaptation to this model and design of the model function – decision of the differential equation of the second order, depending on the 5 basic variables:

α – a coefficient, expressing the speed of adjustment of the discrepancy between the project execution stage of OP and real financing;

β – a coefficient-mismatch between potential and actual interference of the authorized body for implementation of the Operational Programme;

γ – coefficient expressing a tendency for costs on an intermediate stage of the Project;

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u – coefficient expressing external interference (eg. impossibility of performance of a stage of a project beyond the Beneficiary conditions);

$G1$ – coefficient expressing the potential value of the intervention of the authorized body for implementation of the Operational Programme.

```
Print["MODEL FOR STABILIZATION, CONTROL AND ADEQUATE INTERVENTION ON THE AUTHORIZED BODY TRACKING
PROJECT IMPLEMENTATION OF AN OPERATIONAL PROGRAM"];

α = Input["Insert expressing the speed of adjustment of the discrepancy between the project execution
stage of OP and real financing -  α"];(* 0.01 *)
Print["Coefficient expressing the speed of adjustment of the discrepancy between the project execution
stage of OP and real financing α = ", α];

β = Input["[" Insert coefficient-mismatch between potential and actual interference of the authorized body
for  implementation of the Operational Programme - β"];(* 0.1 *)
Print["Coefficient-mismatch between potential and actual interference of the authorized body for
implementation of the Operational Programme β = ", β];

γ = Input["Insert coefficient expressing a tendency for costs on an intermediate stage of the Project- γ"];(* 0.05 *)
Print["Coefficient expressing a tendency for costs on an intermediate stage of the Project γ = ", γ];

u = Input["Insert coefficient expressing external interference (eg. impossibility of performance of a stage
of a project beyond the Beneficiary conditions) - u"];(* 1.8 *)
Print["Coefficient expressing external interference (eg. impossibility of performance of a stage of a project
beyond the Beneficiary conditions) u = ", u];

G1 = Input["Insert coefficient expressing the potential value of the intervention of the authorized body
for implementation of the Operational Programme - G1"];(* 0.007 *)
Print["Coefficient expressing the potential value of the intervention of the authorized body for implementation
of the Operational Programme G1 = ", G1];
Print["We receive the following simple differential equation from the second row: "];

Print["y''[t] = ", -(α*γ+β) y'[t] - α*β*γ*y[t] - α*β*u + α*β*G1];

y0 = Input["Insert initial condition to solve the differential equation - y[0]"]; (* 1 *)
Print["Initial condition to solve the differential equation y0 = ", y0];
y1 = Input["Insert final condition to solve the differential equation - y[1]"]; (* 9 *)
Print["Final condition to solve the differential equation y1 = ", y1];
t0 = Input["Insert beginning of the period for which we examine model"];
Print["Beginning of the period for which we examine model t0 = ", t0];
t1 = Input["Insert end of the period for which we examine model"];
Print["End of the period for which we examine model t1 = ", t1];

Print["Graphics solution of equation y[t] and y'[t] and y''[t] in the interval [", t0, ", ", t1, "]"];
s = NDSolve[{y''[t] + (α*γ+β) y'[t] + α*β*γ*y[t] + α*β*u - α*β*G1 == 0, y[0] == y0, y[1] == y1}, y, t];
Plot[Evaluate[{y[t], y'[t], y''[t]} /. s], {t, t0, t1}, PlotStyle -> Automatic]
```

Figure 1: The modified module for stabilization control and adequate intervention of authorized bodies – Observation Committees of Operational Programmes (OPs)

We explicitly note, that in the classical model of Phillips parameter $u = 1$. This parameter, in our proposed modification plays an important role.

Thus, the basic differential equation model is of the form:

(1) $$y''(t) + (\alpha\gamma + \beta)y'(t) + \alpha\beta\gamma y(t) + \alpha\beta u - \alpha\beta G1 = 0.$$

MODEL FOR STABILIZATION, CONTROL AND ADEQUATE INTERVENTION ON THE AUTHORIZED BODY TRACKING PROJECT IMPLEMENTATION OF AN OPERATIONAL PROGRAM

Coefficient expressing the speed of adjustment of the discrepancy between the project execution stage of OP and real financing $\alpha = 0.01$

Coefficient-mismatch between potential and actual interference of the authorized body for implementation of the Operational Programme $\beta = 0.1$

Coefficient expressing a tendency for costs on an intermediate stage of the Project $\gamma = 0.05$

Coefficient expressing external interference (eg. impossibility of performance of a stage of a project beyond the Beneficiary conditions) u = 1

Coefficient expressing the potential value of the intervention of the authorized body for implementation of the Operational Programme G1 = 0.007

We receive the following simple differential equation from the second row:

y''[t] = -0.000993 - 0.00005 y[t] - 0.1005 y'[t]

Initial condition to solve the differential equation y0 = 1

Final condition to solve the differential equation y1 = 9

Beginning of the period for which we examine model t0 = 0

End of the period for which we examine model t1 = 50

Graphics solution of equation y[t] and y'[t] and y''[t] in the interval [0, 50]

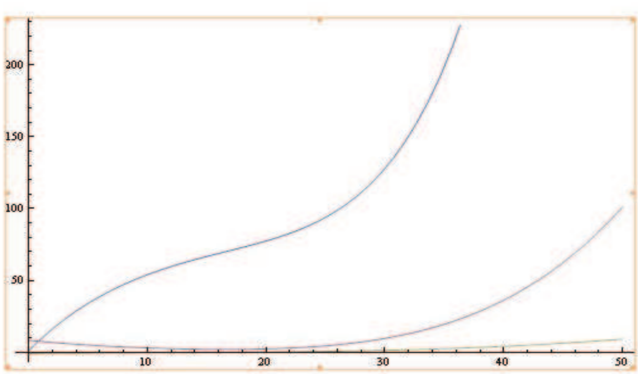

Figure 2: The test provided on our control example

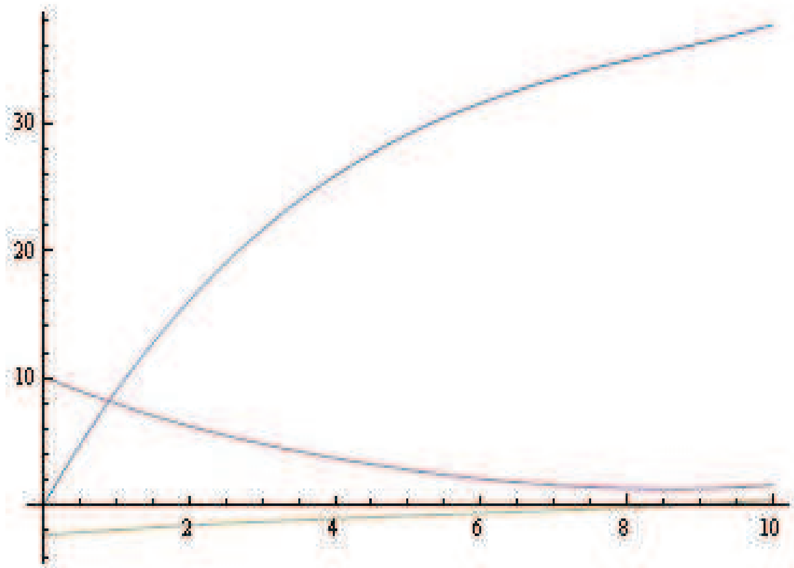

Figure 3: Some experiments

2. Simple module implemented in programming environment MATHEMATICA for conducting experiments

In this section we propose the modified module in programming environment MATHEMATICA (see Fig. 1).

3. Experimentation of the developed model for stabilization, control and adequate intervention authorized body overseeing the implementation of the Projects of the Operational Programme

As a result of the implementation of this program module, we get (see Fig. 2 – Fig. 4)

4. Conclusions

The module provides for study of the model function y (t) and its derivatives.

Using the operator ManipulatePlot of CAS MATHEMATICA opens an opportunity for animations (the study of inflection points, constructing "Phillips curves" and others.)

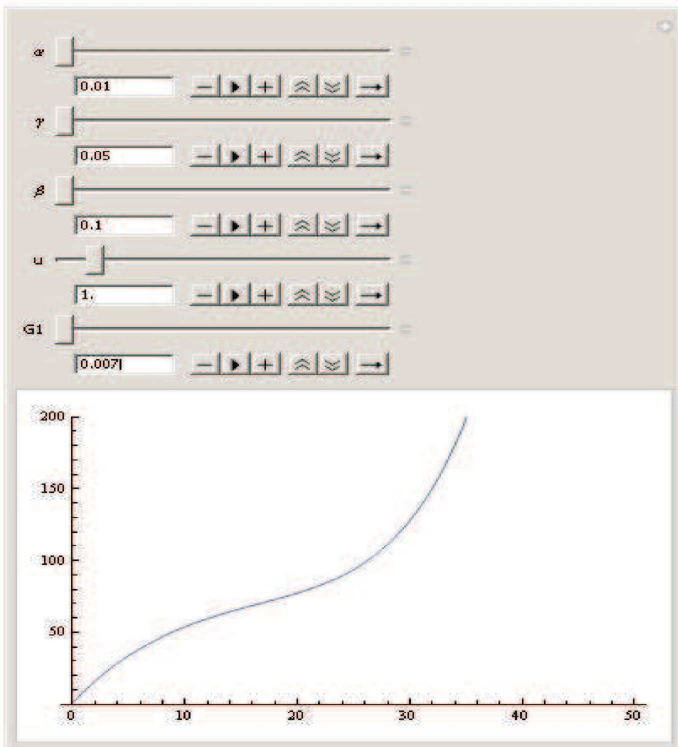

Figure 4: An example of the usage of dynamical solution of the differential equation and graphical representation. The plots are prepared using *CAS Mathematica*

That can be used with success by the authorized body overseeing the execution of the Project by operational Programme for making appropriate decisions and intervention.

We'll explicitly mention that the studies, described in this article, are an integral part of a much more general software platform, including statistical analysis of the results of the intermediate stage in the implementation of the OP "Phillips curves" to conduct ultra-sensitive analysis and other important components - issues that are not subject to current research.

The proposed model could be used to create adaptive learning content in Distributed Platform for e–Learning (DisPeL) and to add automation of the administration of the learning process, and provides full integration between the administration and learning [5–8].

For related results, see [9].

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