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AN ONLINE COURSE AND LABORATORY FOR STUDYING AUTOMATIC CONTROL SYSTEMS

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Introduction. Automatic control systems are widely used in industry and everyday life. For example, they are used for automatic control of temperature, pressure, and liquid levels in petroleum and other industries; speed in moving aircraft and spacecraft; and robotics, including operations dangerous to human health or life as well as for automatic control of modern home appliances (smart houses, heating and condition systems, etc.). For designing such systems, the real properties of a control object, including its inertia, imperfection and interaction with the medium, should be taken into account. Although significant differences exist among these processes, the design of automatic control systems (ACS) is based on the same principles and requires the use of special mathematical tools.

This is the subject of a course on the fundamentals of ACS theory. The course is a basic one in automation, measurement, electrical and computer engineering, mechanical, non-destructive control, aerospace and chemical engineering. Such course can be implemented as usual study course in college or university and also e-learning via the Internet.

Problem formulation. An important requirement for such online courses and hands-on labs is to provide access to them with modern mobile devices such as laptops and tablets. This requirement is connected with an increase in the mobility of students, engineers and researchers who are no longer tied to their work places. They need to conduct research using online labs not only at work or at home, but also when they have days off or are travelling. It should also be noted that modern users need to carry out their research in an interactive mode with video broadcasts in real time for operation control of the hands-on lab and to avoid damaging it.

A separate important issue of hands-on or virtual labs is the installation of additional special software for operation. It complicates use of personal computers (PC) in places with public PCs or at work if installation of new software is limited.

Problem solution. To meet these needs, both the online course and laboratory for the ACS study were developed within the frameworks of Tempus project 530 278 - TEMPUS-12012-1-DE-TEMPUS-JPHES "iCo-op: Industrial Cooperation and Creative Engineering Education based on Remote Engineering and Virtual Instrumentation".

The purpose of this course is to acquire basic knowledge of modeling, analysis, simulation and design of the ACS of real objects. Prerequisites for the course are knowledge of fundamental high school mathematics and electrical engineering. The course includes 11 lectures, 3 remote laboratory projects via the Internet with video broadcast for operation control of the lab in real time and 1 practical work "Calculation of the proportional-integral-derivative controller for control object with specified dynamic parameters." The volume of the course is 20 study hours and its duration is 2 months.

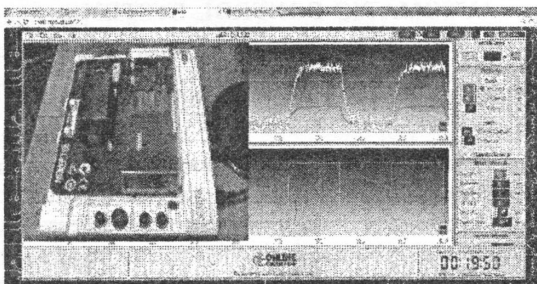


Figure 1 - Web - interface of the online laboratory for ACS research in real time

I. A. Cardoso, T. Restivo, P. Cioga, M. Delgado, J. Monsanto, J. Bicker, E. Nunes, and P. Gil, "flock.uc.pt - A Web Platform for Online Educational Modules with Online Experiments", International Journal of Online Engineering, vol. 9, Special Issue 1, 2013. 2. ICo-op. [Online]. Available: www.ico-op.eu.

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THE ONLINE COURSE AND HANDS-ON LABORATORY FOR MEASUREMENT METHODS STUDY

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Introduction. Measurement is an integral part of industry and daily life. Definitely, there are many measurements in robotics, medicine, oil and gas,