LABORATORY ON MULTIDISCIPLINARY AND INTERDISCIPLINARY EDUCATION

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Abstract:

Contemporary industrial processes become more and more complex and sophisticated. Education must maps the existing strong synergism between variety of separate scientific, engineering and managerial disciplines. Dept object-oriented knowledge and skills should be combined with broad multidisciplinary and interdisciplinary education. To make some steps toward above direction a new laboratory for engineering education has been created. The most established strategy of training and education now is acceptance of two different principles: computer based modeling and simulation and physical modeling of electro-mechanical or mechatronic objects like: inverted pendulum, gyroscope, 3D crane etc. Nowadays exist a solid experience in training and education using computer modeling. This allows achieving good results mainly in theoretical aspects. The main disadvantages of this approach consist in decomposition of theoretical and practical education, a lack of flexibility.

The main concept of new laboratory consists in incorporating computer and physical modeling via mapping theoretical models on universal 2D thermal model. The mapping process is accomplished in the following steps-creation a meta-model with generalized plant states; use this states as a set points for multivariable controller; tracking set-points by PLC-based closed loops; temperature measurements Infrared Thermography devices. The main Laboratory stand considers four main modules: modeling and simulation module, executive module, operational module and task module. The modeling and simulation module create the studied object: dynamic model with lumped or distributed parameters, steady-state model, stochastic model, network model etc. This module has a particular submodule which transforms in relevant way the original computer model in finite elements model with low dimension ($n \leq 100$). All software tools are allowable in the modeling and simulation. The executive module transforms output values from modeling and simulation module into physically measurable signals (temperatures). It considers four submodules: PLC module, 2D thermal wall, physical model of environment and module mapping the original model of the studied object in 2D physical image. Operational module fulfils all functions on control, diagnosis, signal processing, optimization, reasoning, machine learning. It could be activated by the signals both from the modeling and simulation model and executive module as well. Task modules formulate the concrete goal which will be studied in the laboratory stand. The proposed stand is multidisciplinary and allows training and education in the following disciplines: (i)Control and system theory: advanced, intelligent, large scale system control (ii) Artificial intelligence: case-based reasoning, machine learning, intelligent diagnosis, classification (iii) Operational research: decision making, planning, forecasting, etc. Each of listed disciplines could be studied in combination with another from the same area. This is the interdisciplinary aspect of the proposed laboratory stand.

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