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Laboratory Learning Outcomes in Automatic Control- are they up to date?

Most engineering students will have a first level course in the subject of Automatic Control as part of their engineering program. This subject requires the students to combine their prior knowledge in mathematics and physics to take on tasks such as modeling and simulation of engineering systems as well as experimental work. In this study, the focus lies on the laboratory learning outcomes of the first level course in Automatic Control given at Swedish Universities. There is a common understanding among the Automatic Control community that the theoretical content of the first level course has, to a large extent, been the same since it was first given. However, it is not as clear as to how the laboratory part of the course has developed.

Aim: The aim of this study is to investigate what the current laboratory learning outcomes are in the first level course in Automatic Control at Swedish universities, to compare them to state-of-the art as well as to determine if they are in need of revision.

Method: Comparative analysis of the laboratory learning outcomes of the first level course in Automatic Control at the ten largest engineering faculties in Sweden, in terms of full time engineering students, that also offer a mechanical engineering program. The laboratory learning outcomes are gathered from the course syllabi of the first level course at each university. Comparison is made with the fundamental objectives of engineering instructional laboratories by ABET which can be divided into the cognitive, psychomotor and affective domains.

Results and analysis: Only seven out of the ten considered universities offer an engineering program in mechanical engineering. The course syllabi of six out of the seven universities cover the cognitive objectives of laboratory learning outcomes well. These include the objectives Models, Experiment, Data Analysis and Design. This result is in line with the trend of engineering educations becoming more theoretical and less practical. Some universities do also cover objectives within the affective domain (Teamwork and Communication). It is also found that, often, the learning outcomes are vaguely stated, possibly not reflecting the true course content.

Conclusions: This study suggests including, e.g., the learning objective “Learn from Failure” into the course syllabi of the first level course in Automatic Control. Moreover, it is argued that all ABET’s learning objectives could be incorporated but that the learning objectives used should be made more specific and focus on certain aspects of laboratory work for any given course. In general, the learning outcomes of the first level course in Automatic Control are in need of revision.