International Journal of Mechanical Handling and Automation
Vol. 1: Issue 1
www.journalspub.com

Review on the Use of PLCs in Control System Education

S. Sharmila, T. Devi, P. Garg*
University of Madras, Tamil Nadu, India

Abstract

The paper reviews the previous researches devoted to control system education. It shows how academic institutions are utilizing PLCs in education and how it can complement the traditional focus on continuous-based control. A key objective of this paper is to review the use in mechanical engineering education, which traditionally takes place in control systems. This paper also proposes that implementation of PLCs into a control systems course can enable a natural integration of continuous and non-continuous control theory.

Keywords: control system, automation, PLC, education, laboratory, controller

Corresponding Author
E-mail: sharmisn06@gmail.com

INTRODUCTION

Mechanization assumes extraordinary part in contemporary enterprises. Through the twentieth century it has been developed from basic consecutive control to the convoluted gadgets frameworks. Today it is difficult to envision a manufacturing plant without robots, numerically controlled machines and programmable rationale controllers (PLC). Conventional control frameworks building courses concentrate on the hypothesis and arithmetic of constant based control frameworks and infrequently include the utilization of PLCs, which give a magnificent stage to show criticism control. Just a couple programs have incorporated a particular concentrate on non-constant (on/off) control usually utilized as a part of mechanical situations. Engineering control problems can generally be categorized solely or as a combination of the following three ways:

1. Continuous Linear – these systems can be described by linear differential equations, and exact equations can be used to design controllers.
2. Continuous Non-linear – these systems can be described with differential equations that are non-linear, and the controllers can be designed with some effort. In some systems differential equations are not available, forcing reliance on other methods, such as heuristic rules.
3. Non-continuous – these systems have discrete states and are characterized with on/off transitions of inputs and outputs. Logical decisions are required to control the system.

Control Systems Engineering is customarily observed as a "dry" course by understudies with a mechanical fixation. The well-known reading material on the subject are implied for a more broad designing understudy gathering of people, cover the hypothesis that is regularly connected with the subject, and concentrate primarily on nonstop straight controls. A couple of modern, synthetic, and electrical building and in addition different innovation programs have incorporated some prologue to PLCs into their projects, where they are frequently introduced as a major aspect

of a laboratory course. However, several programs have begun offering courses dedicated to learning and applying PLCs. In contrast, very few mechanical engineering programs offer any exposure to PLCs throughout the curriculum.

Programmable Logic Controller – PLC

PLC is a standard mechanical control gadget that gives a basic, yet hearty, strategy for controlling assembling and element forms. Accordingly of their minimal effort, versatility, and unwavering quality, PLCs are by a long shot the most well-known control component utilized by assembling organizations of all sizes for environment control, sustenance preparing, movement control, and robotized test gear. However despite the fact that PLCs are intensely utilized by industry, their utilization in showing control hypothesis ideas is unprecedented for mechanical building programs. Otherwise called programmable controller, PLC is the name given to a kind of PC regularly utilized as a part of business and mechanical control applications.

PLCs can differ from office computers in the types of tasks that they perform and the hardware and software they require performing these tasks. All PLCs monitor inputs and other variable values, make decisions based on a stored program, and control outputs to automate a process or machine. Yet, they remain the most common and useful component in controlling manufacturing processes and machinery.[1]

Mechanical engineers need to understand how issues of control can affect their designs of new machines and operator interfaces. Unfortunately, many engineers lack knowledge in areas of cross-discipline knowledge. They become specialized in their own field to the fault of not considering (or even knowing) how their role in a project impacts the other participants. If students can gain a strong understanding of how to apply control theory in real-world applications, they will diversify their knowledge set and can communicate and design more effectively. Additional arguments have been made for including PLCs in controls education. Fast economic growth, searching for new, clearer technologies are the main factors of progress in the industry. Because production becomes more efficient, then controllers become faster and more complicated. [1]

PLC IMPLEMENTATION

Evaluating the writing for portrayals of PLC undertakings (see Table 1), it was uncommon to discover papers where all writers were from a mechanical building department.25 The rest of the articles incorporate or are exclusively composed by people from electrical/PC designing or designing innovation divisions. The absence of PLC tasks shows that not very many projects are exploiting a flexible instrument, though papers including communitarian between departmental endeavors exhibit the ability or need to gain by shared traits between orders. The joint efforts likewise highlight the hearty list of capabilities that PLCs have picked up since their substitution of bulky electro-mechanical frameworks 40 years ago.

In particular, one laboratory contains an array of experiments with electrical, mechanical, pneumatic, and hydraulic systems. Note that very similar projects are offered from both mechanical and electrical engineering departments, yet the outcome of each project is appropriate to the area. For example, students in both areas of engineering investigate the control of DC motors and conveyors.

Non-specialized variables, that have not yet been said, likewise add to the PLC's esteem:

(a) Local accessibly of parts

(b) Large introduced base

(c) Easy for non-build experts to interface with

(d) Understood by a substantial number of authorized circuit repairmen

(e) Very hearty and tough parts.

The PLC's capacity to execute both non-persistent and consistent control capacities and its pervasive use in industry make it a profitable apparatus in designing training.

CONCLUSIONS

Implementing PLCs into a control systems course for mechanical engineering students can enable a natural integration of continuous and non-continuous control theory. The presentation of the industrial and academic background of PLC development and use has demonstrated the PLC’s value and versatility.

Arguments made challenge the current structure of most control system engineering courses for their sole continuous-based systems focus and encourage the increased exposure of students to the PLC. As an industry-wide tool with functionality for non-continuous and continuous systems, it will enhance the value of controls education by allowing a more holistic approach.

Passing over the group of specialized controllers, the most of programmable logic controllers used in industry are modular. In that manner they are more flexible in application. Contemporary industrial trends require preparation of new engineers that can cope with certain tasks from designing a system, through code development, to set the whole process in motion. The Institute of Engineering Processes Automation and Integrated Manufacturing Systems at the Mechanical Engineering Faculty has five laboratories, where students can evolve their skills. One of these is the Laboratory of Sensors and Industrial Networks. At the laboratory rooms several types of industrial networks, like AS-I, CAN, Profibus, CC-Link, MelsecNet and Ethernet and are usually installed. The other meaning system is distributed control based on Profibus network, used in transportation system. Other equipment is visualization and control panels, frequency processors, network and PLC expansion modules.

REFERENCES

1. Michael R. Foster, Chad Hammerquist, Robert Melendy, A Review of Programmable Logic Controllers in Control Systems Education, Faculty Publications - Department of Mechanical and Civil Engineering, 2010.
2. J. Świder, K. Foit, The use of the Mitsubishi PLC systems in student’s preparation for realization of industrial tasks, J of Achievements in Materials and Manufacturing Engineering, January-February 2006; VOLUME 14, ISSUE 1-2.
3. http://electrical-engineering-portal.com/resources/plc-programming-training.