ME 106

Fundamentals of Mechatronics

Laboratory Manual

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by

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Introduction

If you look around, you'll notice that many of the devices you use in the course of a day are mechatronic, that is, they integrate mechanical and electronic functions in a synergistic way. In fact, it is difficult to ***avoid*** mechatronic devices! Microwave ovens, automatic teller machines, washing and drying machines, dishwashers, cameras, camcorders, VCR's, CD players, automobiles… These are all mechatronic devices. And not only consumer products, but industrial processes, such as a semiconductor fab, also are highly mechatronic in nature.

The overarching philosophy in mechatronics is that enhanced performance, flexibility, and reliability can be obtained in a product or process through the integration of mechanics and electronics under the control of software.

Because of the ubiquitous nature of mechatronics, the mechanical engineer must understand the fundamentals of mechanics, electronics, and software in order to be successful in today's world. By and large, most undergraduate mechanical engineering programs do a good job teaching the fundamentals of mechanics, but fall short in giving students the necessary understanding of electronics, computer interfacing, and how these are integrated in product design and manufacture. The experiments described in this manual are an attempt to give the student a broad range of hands-on experiences to help build a solid foundation in analog and digital electronics, sensors and transducers, actuators, and microprocessor interfacing, so he or she can begin to function effectively as mechanical engineer in an increasingly mechatronic world.

We developed a new laboratory at San José State University to support the experiments described in this manual. The Mechatronic Engineering Laboratory has nine workbenches that each have state-of-the-art electronic test and measurement equipment (oscilloscope, function generator, multimeter, and power supply), a personal computer, and a printer. Teams of two students are assigned a solderless breadboard and a toolbox of electronic components at each bench. Depending on the experiment, additional equipment, such as a microcontroller board, are assigned to each team. The laboratory allows students to learn about fundamental concepts in mechatronics in a hands-on, exploratory manner.

Appendix A: Pin-outs of Common Components