Teaching CNC Machine Programming using Virtual Machines

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ABSTRACT

Single station manufacturing cells are the most common manufacturing system in industry. Such cells may be operated manually or automated, but quite often the machine in these cells is a computer numerical control (CNC) machine in order to increase productivity and quality. Industrial and mechanical engineers in any manufacturing or production position are expected to have a basic understanding of CNC machines. Specifically, experience in CNC programming will be very beneficial in such positions.

CNC programming experience was provided to students in the industrial engineering program at UW – Platteville via a table-top CNC mill from 1988 through 2005 and then through a larger stand-alone CNC mill from 2005 through 2010. When a team of students did not exercise adequate care to clear the tool from the tool magazine, before moving the machine spindle and tool to the job, the tool post and the spindle drive were deformed. The single technician in the college did not have any time to diagnose and fix the problem. The industrial engineering faculty became creative in identifying and selecting virtual CNC machines for the usage in two laboratory exercises. The virtual CNC machines provided hands-on experience to the students in CNC lathe and mill programming.

The paper and presentation will focus on the author's successful method of teaching CNC lathe and mill programming using virtual CNC machines that are available at http://www.cncsimulator.com/ or http://www.cncsimulator.com/ or http://cncsimulator.com/. The idea of the "CNCSimulator Pro" is to provide the CNC community with a versatile and contemporary full three-dimensional (3D) CNC machine simulator with computer aided manufacturing (CAM) capabilities. The CNCSimulator is available to everyone, provided they have an internet connection and a computer that uses the Windows operating system. Currently, CNCSimulator supports two and three axis turning and milling machines using a Fanuc inspired G-code language as well as a laser cutter, a water-jet cutter, a plasma cutter and a 3D Printer. The program is free for anyone to use, but with limitations for non-paying users. The simulator can be downloaded and installed by each student in a course free of cost, or the engineering and technology programs may buy the simulator for a very low price and install it on multiple PCs in a laboratory.

The audience will find the presentation useful because most engineering and technology programs face budget and space constraints to keep CNC machines updated in laboratories. Typical programming assignments in the industrial engineering course on manufacturing systems design are presented and discussed.

Topics/Areas: Science Education, Education Technology, Educational Foundations, Education Technology, Industrial Engineering and Management

REFERENCES

1. http://www.cncsimulator.com/ or http://www.cncsimulator.com/ or http://cncsimulator.com/
2. GROOVER, M. P., 2008, *Automation, Production Systems, and computer-Integrated Manufacturing, 3rd Edition,* (Prentice Hall)
3. CURRAN, K., AND STENERSON, J., 2001, *Computer Numerical Control – Operation and Programming,3rd Edition,* (Prentice Hall)