Development of G-Code Interface Using Microsoft Visual Basic for AB L63 Control System

AG Rodriguez, LR Vidal, JM Diaz, and V Torres-Argüelles
Autonomous University of Ciudad Juarez
Ciudad Juárez, Chihuahua, México

Corresponding Author E-mail: rdz.alfa@gmail.com

Abstract. This paper discusses the development and implementation process for a user interface to translate G-Code (ISO6983) using Microsoft Visual Basic 2010, and OPC communication protocol. This interface was developed in three modules, the first one verifies syntaxes and lexicon, the second is a command converter for a Programmable Logic Controller Allen Bradley L63 using a SERCOS interface card and servo drive ULTRA 3000, and the last one executes motion control instructions. The interface is used for a profile milling process, on a XY plane and using G00, G01, G02 and G03 codes generated in a Fanuc postprocessor 3XMILL. The interface shows errors detected in the verification module according to the parameters established and identifies the corresponding line; monitors the XY position in real time, The interface allows line by line execution or in automatic mode. The interface does not call information for cutting speed, tool advance speed, and spindle speed or tool compensation from the NC program. The interface was also developed using incremental and reuse oriented methodologies.

Keywords: Interface, G-Code, Programmable Logic Controller, Milling process, servo drive, communication protocol.

1. Introduction

The increasing demand for quality products, introduces the need to develop and improve CNC (Computer Numerical Control) machine tools. CNC systems have a computer that reads and interprets instructions in machine language or G-Codes for guiding a tool (Albert, 2001). The Numerical Control (NC) program is the one that details the instructions step by step indicating the machine what path to follow and which operation to execute for the machining of a part. In the beginning CNC machines has an exclusive use by the aerospace industry, now they have been adapted to other industries like wood (Nagata et al., 2009) and plastics (Zhang et al., 2008). What differentiate the machines for applications are settings like load charges, vibration, cutter, working area, machining speeds and precision requirements. Through the Computer Aided Design and Computed Aided Manufacture (CAD/CAM) is possible to create different part designs and generate the corresponding NC program with a postprocessor. Postprocessors are translation tools of CAM software that converts a design or path in a language that can be understand by the control module of the CNC machine.

With implementation of Programmable Logic Controller (PLC) (Bolton, 2009) the motion control functions can be executed helped by motion control instructions and motion analysis software. The motion control is an automation field in charge of developing technologies and products that improve precision systems significantly (Rockwell Automation, 2013). Servomotors are controlled by the PLC through the use of a servo drive and a communication interface so as the i/o cards for sensors and other actuators.

In the last years, the research of G-Code interpreter has taken relevance for the aim to develop open systems with universal applications, some cover standards ISO6983 and basic NC program structures (Chen et al., 2012, Qi&Yingli, 2011, Liu, 2007, and Guo et al., 2012) and others cover the most recent standard STEP-NC (STandard for the Exchange and Sharing of Product) (Lan et al., 2008). In general, the trend marked by the interpreter developers has been for modular systems for its easy expansion for new techniques and standards and open systems oriented with the purpose of developing universal products.

With advancing technology of electronics and microcomputers field in industry, new technologies have emerged for process control (Huijuan et al., 2011). The data transmission is an important matter; nowadays the Dynamic Data Exchange (DDE) is a reliable option for communication protocols developed by Microsoft to exchange data between several applications. Based on the open standards and open connectivity objectives the OPC (Object-Linking and Embedding (OLE) for Process Control) technology has become a key for the development of open systems through the information management between applications taking Microsoft's OLE COM (Component Object Model) and DCOM (Distributed Component Object Model) technologies as frameworks for software. The applications can be GUIs (Graphical User Interfaces), PLC’s, databases, fieldbus devices, etc. Currently, OPC technology is highly used by industry, for example in the simulation of