

**COMPUTER NUMERICAL CONTROL MACHINE CONTROLLER (CNC) BY USING
VERY HIGH SPEED INTEGRATED CIRCUIT HARDWARE
DESCRIPTION LANGUAGE (VHDL)**

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PENGAKUAN DAN PENGESAHAN LAPORAN PENYELIDIKAN SFZ 4399 A/B

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk Numerical Control Machine Controller (CNC) by using Very High Speed Descriptive Language (VHDL) oleh AMEENUL UMMAH BIN SALLEHUDDIN no. matrik: UK12953 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Fizik sebagai memenuhi sebahagian daripada keperluan memperoleh Ijazah Sarjana Muda Sains Gunaan (Fizik Elektronik & Instrumentasi), Fakulti Sains dan Teknologi, UMT.

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DECLARATION

I hereby declare that this project report entitled Computer Numerical Control Machine Controller (CNC) by using Very High Speed Descriptive Language (VHDL) is the result of my own research excepts as cited in the reference

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PENGAWAL MESIN BERKAWALAN NUMERIK KOMPUTER (CNC) DENGAN MENGUNAKAN BAHASA PENGHURAI PERKAKASAN LITAR BERSEPADU BERKELAJUAN TINGGI (VHDL)

ABSTRAK

Sistem perisian computer 'Very High Speed Integrated Circuits Description Language (VHDL) telah mempunyai kesinambungan yang tinggi di dalam bidang kawalan digital karabagi mesin kawalan numeric computer (CNC). Di dalam bidang ini, kadar kelajuan yang tinggi bagi memproses masa linkaran servo adalah amat kritikal. Dengan pelaksanaan program kepada alat yang boleh diubah seperti 'Field Programmable Gate Array'(FPGA) mempunyai banyak kelebihan berbanding mikroprocessor dan pemprosesan signal digital dengan kadar kompleksiti yang sama seperti prosesor yang lain kerana sistem arkiteknya yang terbuka membuatkan FPGA amat sesuai untuk diaplikasikan bagi sistem di dalam satu cip. VHDL adalah satu bahasa yang digunakan bagi menerangkan system digital. VHDL digunakan bagi menyokong rekabentuk hirarki, dokumentasi dan simulasi suatu peralatan daripada get mudah sehinggalah ke system digital yang kompleks. Sifat VHDL yang versatail membolehkan ianya digunakan untuk projek ini. Dengan menggunakan bahasa ini, CNC telah dibangunkan dengan menggabungkan 6 subsistem dimana ianya adalah unit kawalan, integrator, penukaran mata alat, kawalan spindle, kawalan pergerakan dan kawalan penyejuk. Bagi mengesahkan bahawa sistem CNC ini adalah betul, simulasi dilakukan ke atas setiap model. Setiap subsistem, disimulasi bagi memastikan setiap nilai output adalah betul. Perbandingan diantara hasil simulasi dan parameter input, membuktikan bahawa CNC telah menghasilkan signal seperti mana yang dimahukan oleh spesifikasi yang telah ditetapkan. Penggunaan VHDL, tidak hanya membangunkan CNC dengan cara yang lebih eknomi malah rekabentuk CNC itu sendiri dapat diringkaskan.

COMPUTER NUMERICAL CONTROL MACHINE CONTROLLER(CNC) BY USING VERY HIGH SPEED INTEGRATED CIRCUIT HARDWARE DESCRIPTION LANGUAGE(VHDL)

ABSTRACT

Very High Speed Integrated Circuits Description Language (VHDL) has gained a lot of interest in the field of high-speed computer numerical control machine digital controllers (CNC) where high processing speed at the servo loop update time is critical. With the implementation of the programme to reconfigurable devices like Field Programmable Gate Array (FPGA) have advantages over microprocessors and DSP with similar logic complexity because their open architecture makes them suitable for system on-a-chip applications. VHDL is a language for describing digital systems. VHDL is intended to support the hierarchical design, documentation, and simulation of hardware from simple logic gate to complex digital systems. Hardware designs can be specified as purely behavioral descriptions, data flow and structure. The versatility of VHDL allows it to be used for this Computer numerical control machine system circuit technology while remaining independent of underlying implementation. By using this language, CNC is developed by combining six subsystems which are Control Unit, Integrator, Tool change Spindle control, Motion Control and Coolant control. To verify the CNC system is correct, a simulator is the model. Every subsystem is simulated to make sure the output of CNC is correct. From the simulation result, all of the objectives had been achieved. Comparison between simulation result and input parameters shows that CNC outputs are archived all the specification needed. The use of VHDL has not only made the development of CNC design more economically but has simplified the CNC development process by using an integer rather than binary that made the system more complicated.