



MOLOCH2 (NO 17905/17950)

Integration on SoPC of position and speed control of three phases BLAC motors

Abstract of the project

The developed SoPC is dedicated to motion control of multi axes drives. It allows real time positioning of x-y table by mean of linear, synchronous permanent magnet motors. The FPGA circuit comprises (see bloc diagram) : **1) Position Controller** : state space control of position and speed, with the feature to set within the FPGA circuit all the parameters of the state controller, by using a RS232 interface; **2) Clark/Park** : the coordinates transformation for the vector control of the phases currents; **3) USB interface** and **DDR Controller** : allows to download the targeted trajectory of the motion, and to monitor the phases currents and the real trajectory via the DDR memory; **4) Setpoint Generator** : processing of position, speed and acceleration references from the trajectory data. In addition, an extrapolator filter and estimate the encoder signals in accounting for the processing delay up to the application of the PWM controls. For that, the linear least squares method is used, which deliver the offset and the slope for the extrapolation of the three above mentioned signals; **5) 8 bits parallel interface** : for data exchange between the PWM unit and the phases currents given at the output of the ETEL's electronic drive board. Further valorization of this project consists in merging this board with the SoPC one, leading to a unique control-power board. Benefits will reside in performing – within the same FPGA - the PWM signals generation and the control of the AD converters used for the phase currents. As current developments goes ahead in this direction, the bloc diagram already accounts for that merging; **6) AN Ctrl** : two AD controllers dedicated to convert – at a rate of 72 kHz – of the sin/cos encoder signals; **7) Sin/Cos Phase Correction** : phase corrector which compensates for the delay caused by the anti-aliasing filters of the AD converters.

Valorization

In a further CTI project in partnership with ETEL SA, it's expected to realize a new PCB board as described above. This enterprise projects to integrate in this board some algorithms for automatic compensation of the encoder defaults. In addition, the phase currents acquisition will be improved in order to increase the SNR of the measurements. Industrial application of that project will be the rapid print (96 mm/s) of film's master.

The know-how acquired in the project Moloch2 and in the new board development will be useful for the implementation of several flux-weakening controls in the framework of the HES-SO PREM project (No 21350), whose main topic is rotor thermal losses at very high velocity.

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This project was carried out at the EIA-FR (Mr Claude Magliocco, Institut TIN) with the participation of the HES-SO Valais (Mr François Corthay). ETEL SA graciously provided three BLAC motors (2 are linears), and two power electronic boards.