



# Motor Control University

## Vector Control - Getting Started

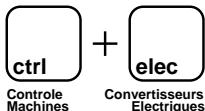
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<sup>1</sup>Ampère Lab CNRS UMR 5005, INSA de Lyon

<sup>2</sup>Microchip Technology Inc.

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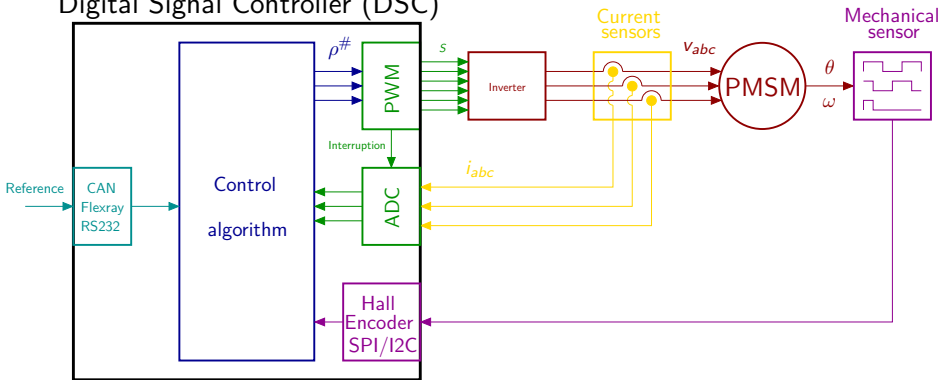
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## Vector control: a sophisticated algorithm

### Digital Signal Controller (DSC)



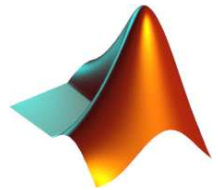
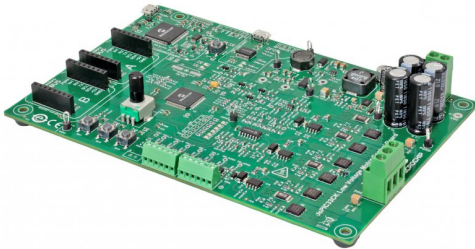
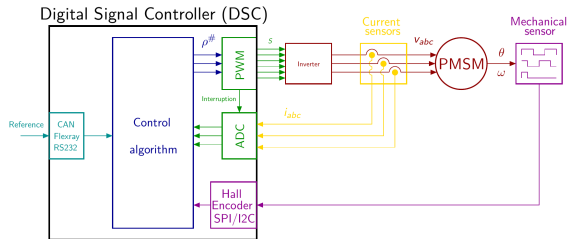
Sampled signals (only indicative)

- Continuous signals
- Interruption
- Frequency > 20kHz
- Frequency = 20 kHz
- Frequency  $\in [0.5 \text{ } 10]$ kHz
- Frequency < 0.5kHz



# Introduction

## Multitask real time algorithm to embed





# Rapid Control Prototyping (RCP)

## Model Based Design :



BEST OF SEVERAL  
DESIGN SERVICES  
AND SERVICES  
LYON



MCPW\_invald\_NeckoControl\_speed\_v2.02 - in68364

Speed control control example

This example provides classical motor speed control

For more details on the control strategy go to page 4 of doc14

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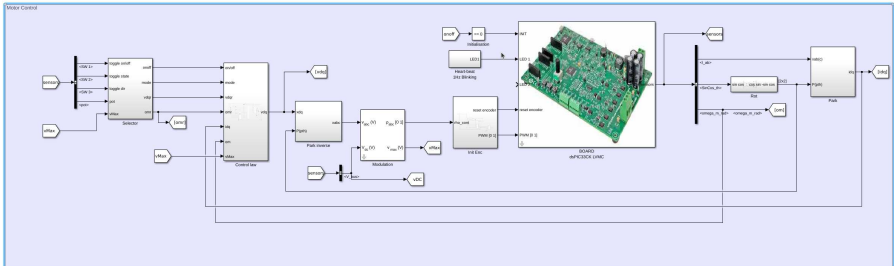
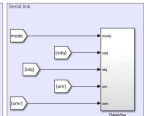
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Last modified on: 01 Jun 2014 09:48:22Z

### How to use this model ..

- **SW1** : ON/OFF -> Enable or Disable the control
- **SW2** : mode ->
  - mode = 0 : Open loop, pot apply a reference voltage in the interval  $[0 - V_{max}]$
  - mode = 1 : Speed Control, pot apply a reference speed in the interval  $[0 - \Omega_{max}]$
- **SW3** : dir : pressing the switch reverse the direction

The motor and the control gains can be modified using the block Motor Choice + Gain Tuning

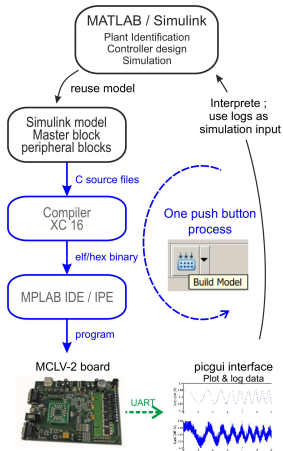




# Rapid Control Prototyping (RCP)

## Model Based Design :

- Simulink "Build" button:
  - ▶ Implements a scheduler
  - ▶ Compile the generated code
  - ▶ Program the chip





# Demonstration





Thank you for your attention



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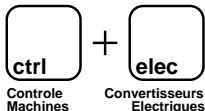
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# Technical appendix

## Mplab Device Block For Simulink

- RCP targeting industrial DSC :



### Microchip Technology MPLAB® device blocks for Simulink

- ▶ +500 chips (dsPIC, PIC32M, PIC32C, SAMx2, SAMx5, SAMx7)
- ▶ peripherals: Digital I/O, ADC, UART, PWM, Quadrature dec, IC, SPI, I2C
- ▶ target DSC, not demo-boards





# Technical appendix

## Software requirements

- Microchip IDE + Compiler

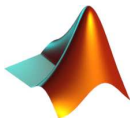


Mplab X



XC 16 compiler

- Matlab + Mplab Device block for simulink



Matlab/Simulink



MPLAB Device Blocks For Simulink



## Hardware requirements

- Motors



Teknic-2310P



Hurst Long - AC300022  
- with Encoder -

- DEVELOPMENT BOARD



DSPIC33CK LVMC



# Technical appendix

## Motor connection

- Phase voltage



PHA	PHB	PHC
White	Red	Black

Both motors

- Encoder



+5V	+3.3V	DGND	QEA	QEB	INDX
Red	$\phi$	Black	Blue	Orange	Brown

Teknic-2310P



+5V	+3.3V	DGND	QEA	QEB	INDX
Red	$\phi$	Black	White	Blue	$\phi$

Hurst Long - AC300022