Motor Control

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Industry Trends: PMSM motors

- **Higher efficiency and environment friendly**
  - Energy efficiency regulations – appliances
  - Battery life – power tools, drones

- **Lower noise**
  - Consumer demand – appliances, HVAC, auto

- **Higher reliability**
  - Automotive applications
  - Reduced maintenance costs

- **Performance**
  - Higher speed & torque – drones, power tools

- **Smaller form factor, weight reduction**
  - Controller / motor integration, consumer applications
Microchip’s Precision Motor Control

- High-performance dsPIC® DSC and PIC32 MCU cores
  - DSP instruction enhancements  
  - Speed and torque control  
  - Field oriented control  
  - Sensorless control  
  - Efficiency, Performance  
  - Efficiency, Reliability  
  - Efficiency, Low Noise  
  - Lower BOM cost

- Optimized peripherals & features
  - Flexible, high resolution PWMs  
  - Intelligent high-speed ADC  
  - Integrated op-amps and comparators  
  - Dual motor control capabilities  
  - Functional safety features & Class B SW  
  - Efficiency, Low noise  
  - Efficiency  
  - Lower BOM cost  
  - System Reliability, BOM

- Development tools, software algorithms and how-to
  - BLDC, PMSM, ACIM motor support  
  - Sensorless Field Oriented Control  
  - Reduce time-to-market  
  - Lower BOM cost
Increasing performance and integration

**dsPIC33E**
- 70 MIPS
- Improved PWM
- 12-bit ADC
- Op-Amps
- 32 – 512KB flash
- 5x5 mm package

**dsPIC33C**
- 100+ MIPS
- Improved MC PWM
- Dual dsPIC® DSC cores
- Integrated PGA
- Multiple high speed ADCs
  - >3 Msps
- 12-bit DAC
- Dead-Man Timer

**PIC32MK**
- 32-bit core
- 100MHz / 125 DMIPS
- DSP and FPU
- Improved MC PWM
- Op-amps
- Up to 7 12-bit ADCs,
  - >3 Msps
- 12-bit DAC
Low Voltage Development Board
- Low voltage output, 48V/15A
- Single motor control with sensor input
- CAN, LIN, and UART ports

High Voltage Development Board
- 110/220VAC input, 1kWatt/400V
- Integrated PFC stage
- Single motor control with sensor input
- Isolated USB, UART, and programmer/debugger

Low Voltage MC Bundle
- Separate control and power boards
- Allows for customer developed power boards
- Power board supports dual motor drive
MPLAB 16/32-Bit Device Blocks for Simulink

- MPLAB® Device Blocks for dsPIC® DSC and PIC32MK

Content
- System Configuration
- Digital IO
- Analog IO
- PWM IO
- BUS UART

FREE VERSION available (limited to 8 IO pins)

dSPIC33EP256MC506 unlimited
A single model is used for simulation and code generation. Environment Controllers select between Simulation and code generation.

Algorithm is developed in the datatype that is used on the uC.
Motor Control Library

optimized MC library functions for FOC:
• transformations:
  • park, clark, inv. clark, inv. park
• PI controller
• atan, sin, cos
• etc.

Simulink model for simulation and ASM library for code generation for maximum performance on the target
It can be so simple

- Simulation
  - control
  - motor
  - load
- Code Generation
- Programming
- Validation

- Seamless integration in Simulink
  no additional IDE needs to be touched

picgui:
high speed data visualisation
records up to 7 signal at 20kHz realtime
Automotive Communication Interfaces
CAN/LIN support for MATLAB

certified LIN Stack from IHR (www.ihr.de)
Microchip CAN driver
CAN/LIN debugtools: K2L MOCCA box (www.k2l.de)
CAN/LIN support for MATLAB

motor control

CAN or LIN communication
CAN/LIN support for MATLAB

Simulatable CAN/LIN messages
Take aways

- Rapid Prototyping incl. existing C-libraries
- Automotive application development
- Seamless integration with Simulink environment
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