TI C2000™ 듀얼코어 마이크로 컨트롤러에 모터제어 알고리즘을 배포하기 위한 솔루션

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Key Takeaways

- Simulate sensorless Field-Oriented Control (FOC) on a dyno setup

- Complete Model-Based Design workflow for multicore microcontroller

- Hardware component and device driver behavior simulation
  - Enhanced on-device profiling
Dual CPUs PMSM Dyno Testing
Workflow for Implementing Field-Oriented Control

- Motor Control Blockset

1. Calibrate Sensors
2. Estimate Motor Parameters
3. Model Motor & Inverter
4. Design Control Algorithm
5. Deploy & Validate

Webinar Series: Field-Oriented Control of PMSMs with Simulink
Demo – PMSMs Dyno Model in FOC Sensorless Control

**Model**
- System requirement
  - TI C2000 dual-core processors
- Controller sample rate is 20kHz
  - Field-oriented control (FOC)
  - Sensorless control
  - Dyno setup (2 motors)
- No sensor delays in my model
- ADC-PWM synchronization

**Multicore Processor**
- How to implement and partition controls into two separated cores?
- How to communicate between CPU1 and CPU2?
- How to make sure task execution meets software requirement?
Simulate Motor Control System with Peripherals and Task Execution
Model Multicore application Using SoC Blockset
Plant Subsystem

Motor 2 shaft is mechanically coupled with Motor 1 and follows the speed of Motor 1. Motor 1 is loaded by Motor 2.

PWM Input

ADC Output
Hardware vs Simulation Analysis

Captured HW signal using External mode

Simulation Result
Task Manager

- Model/Simulate
  - Periodic/async tasks
  - Task priorities
  - Latencies
  - Duration as normal distribution
Model Configuration for Multicore Architecture

CPU #1 (c28xCPU1)

CPU #2 (c28xCPU2)
Inter-Processor Communication with **IPC Blocks**

- Model the communication buffering and delay

![Diagram of Inter-Processor Communication with IPC Blocks](image)

- Define buffer size and timing delay
- Visualize buffer consumption and overwrites
Motor control system modeling with **peripheral interface**

- Motor control peripheral interfaces
PWM Modeling

- PWM waveform simulation
- Event to synchronize with ADC or schedule a task
ADC Modeling

- Convert analog values to digital counts
- Model acquisition/conversion delays and trigger events
ADC – PWM Synchronization

Video: Adding MCU Peripheral Modeling in Motor Control Using SoC Blockset
Enable ADC/PWM synchronization simulation

- To provide stable ADC input, the synchronization between ADC and PWM is required for close-loop motor control.
SoC Builder App
Build, load, and execute SoC model on SoC, FPGA, and MCU boards
SoC Blockset Key Functionalities – On-Device Profiling

- Real-time performance profiling on hardware, including
  - Task execution
  - CPU utilization
  - Communication buffering and delay
  - Real-time SDI view
  - Analysis report
Wrap Up

- Simulate sensorless field-oriented control (FOC) on a dyno setup
- Complete Model-Based Design workflow for multicore microcontroller
- Hardware component and device driver behavior simulation
  - Enhanced on-device profiling
Learn More

- **Recording webinars**
  - Field Oriented Control Made Easy
  - Motor Control with TI Multicore MCUs Using Simulink
  - Implementing Motor and Power Electronics Control on an FPGA-Based SoC

- **Shipping Demos**
  - Partition Motor Control for Multiprocessor MCUs
  - Control PMSM Loaded with Dual Motor (Dyno)
  - Integrate MCU Scheduling and Peripherals in Motor Control Application
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