Motor Control and MQX Operating System

Embedded applications are becoming more complex and putting more pressure on the embedded system software programmers. In a complex system, a number of tasks must run in parallel and in real time under the operating system, including Ethernet, USB and SDHC. One such task is the control of an electrical motor like DC, brushless DC, stepper or even three-phase sinusoidal motors such as PMSM or AC induction motors.

MQX RTOS

The MQX RTOS is a runtime library of functions that programs use for real-time multitasking applications. The MQX RTOS supports MPU applications and can be used with flexible embedded I/O products for networking, data communications, file management and control.

The main MQX application area is for large controller devices such as Kinetis MCUs based on the ARM® Cortex™-M4 processor with peripherals for Ethernet, USB, SDHC and additional support. Some of these devices are equipped with a PWM module and other peripherals designed or suitable for motor control.

When to Use Motor Control Under the MQX RTOS

Typical MQX-based motor control applications control one or more motors with dedicated sensors plus other application functionalities such as Ethernet or USB connectivity, display control and user interfaces. In terms of the time scheduling, advanced motor control applications are naturally based on constant sampling (for example, ACIM and PMSM sinusoidal motor control) or asynchronous events (for example, BLDC motor commutation control) with a fast system response requirement. The required response of the most critical events is usually one to tens of microseconds. The MQX RTOS is a complex system with dynamic allocations and POSIX scheduling and has a system default tick duration of 5 ms. It is evident that the motor control process needs to be serviced with interrupts of high priority.

Motor Control Under the MQX RTOS

The actual implementation of motor control under the MQX RTOS depends on the motor type, control algorithms and application requirements. Each motor control technique consists of periodic and asynchronous tasks.

Writing motor control applications under the MQX RTOS is usually provided as a dedicated motor control driver, independent on MQX task processing. The motor control process is provided by one or more kernel interrupts or MQX highest priority interrupt tasks. The motor control process software is then similar to a standard non-operating system approach. The MQX RTOS is used for initialization of motor control and also non-motor control related tasks such as Ethernet communication in such a way to ensure that the time-critical motor control task is always executed on time and the MQX-based tasks are done in the remaining time slots.

Freescale Enablement

For MQX control applications, Freescale provides hardware platforms, MQX software installation, application notes and reference designs. Motor control under the MQX operating system is described in AN4254. Three-phase BLDC sensorless control with the MQX RTOS using the K60N512 is described in DRM135.
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