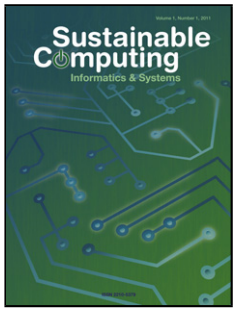

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Energy-Aware Sporadic Tasks Scheduling with Shared Resources in Hard Real-Time Systems

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Highlights

1. We consider the sporadic task with shared resources.
2. The problem of the energy aware sporadic task scheduling is considered.
3. The dynamic priority algorithms are presented to solve this problem.
4. The DVS technique and the DMP technique are used to reduce the energy consumption.

Abstract: We address the problem of minimizing overall energy consumption for sporadic tasks with shared resources in a real time system. Previous algorithms use the static speed to deal with this problem. However, we have proposed a novel scheduling algorithm, called DSSTS, for the sporadic tasks with shared resources. The DSSTS algorithm schedules the task at the dynamic low speed and the task switches to the high speed when it is blocked by another lower priority task. It assumes that each task is executed with its worst case execution time. For energy efficiency, we have proposed a dynamic reclaiming dynamic speed sporadic tasks scheduling algorithm, called DRDSSTS. The DRDSSTS algorithm is an extension of the DSSTS algorithm. It can reclaim the dynamic slack time generated from the early completion task to adjust to the processor speed. Moreover, it can use the DPM technique to put the processor into a dormant mode to save energy when the processor is in an idle mode. The experimental results show that the DRDSSTS algorithm can reduce the energy consumption up to 2.64%~37.16% over the DSSTS algorithm and it consumes 35.16%~71.15% less energy than that of the DS algorithm.
Keywords: sporadic task, energy management, real-time system, shared resource, real-time scheduling

1 Introduction

With the development of the information technology, more and more personal computing and communication devices become mobile and portable. Most of them are powered by batteries. The energy is one important issue for optimization in the design and operation of embedded systems. There are two ways to reduce the processor energy consumption. One is the dynamic voltage scaling (DVS) [1], the other is dynamic power management (DPM) [2]. DVS adjusts to the frequency and voltage scaling to reduce the energy consumption. DPM is to shut down the idle device or put it into the dormant mode to reduce the energy consumption.

Most of the earlier work focusses on the independent task sets. Aydin et al [1] have studied