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RESEARCH ON PREEMPTIONS AND PHASINGS OF PERIODIC TASK SET UNDER RM ALGORITHM[1]

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Abstract. Requirements for embedded systems are very stringent and sometimes conflicting. Overheads incurred by preemptions in embedded systems under RM (Rate Monotonic) scheduling algorithm degrade their real-time performance. Because only the indispensable resources are employed, side effects of the preemptions on performance are even more. This paper creates a preemption model of periodic real-time task set scheduled by RM algorithm to characterize the relationship between the overheads incurred by preemptions and the properties of real-time tasks. Underlying the model, this paper presents a method to use a set of phasings of periodic task set to improve real-time performance of such embedded systems. The phasings are computed by means of an optimization algorithm that is based on evolution strategy and runs on a desktop computer in an off-line way. As the experiment results show, the method can improve the schedulable utilization by reducing preemptions and changing order of preemptions.

Keywords. Embedded systems, Real-time performance, RM scheduling algorithm, Preemption, Phasing, Schedulable utilization, Schedulibility, Evolution strategy
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1 Introduction

The RM scheduling algorithm is one of the most widely studied and used in practice. It is a uniprocessor static-priority preemptive scheme. Based on the following assumptions, the RM algorithm is an optimal static-priority algorithm. That is, if any static-priority algorithm can produce a feasible schedule, so can RM.

1. No task has any nonpreemptable section and the cost of preemption is negligible.

2. Only processing requirements are significant; memory, I/O, and other resource requirements are negligible.

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