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A HYBRID TEST FOR FASTER FEASIBILITY ANALYSIS OF PERIODIC TASKS

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Abstract. *In this paper, the issue of impracticality of testing the feasibility of periodic tasks at run time is studied. We provide an exact test, which is a hybrid solution obtained through both inexact (sufficient but not necessary) and exact (necessary and sufficient) schedulability tests. The task set is divided into two subsets such that (a) all tasks in the first group can be scheduled and the feasibility of this part is tested by the inexact test, while (b) the feasibility of the second group that consists of both schedulable and unschedulable tasks is determined by the exact test. The proposed test outperforms existing alternatives from the perspective of execution time, and becomes an ideal candidate for determining feasibility of online systems. In addition, two well-known bounds, namely LL-bound and H-bound, are compared and it is proved that the H-bound is always true when the LL-bound holds.*
Keywords: Real-time systems, Fixed-priority scheduling, Feasibility analysis, Online schedulability test

1. **Introduction.** When designing hard real-time multitasking systems, one of the most fundamental issues that must be considered is that of timing correctness; i.e., the system must provide predictable behavior under all possible circumstances [1]. A number of scheduling algorithms are presented for scheduling real-time tasks and Rate Monotonic (RM) scheduling is known as the optimal priority assignment technique under fixed priority scheduling class which assigns priorities to tasks based on activation rates; i.e., smaller is the frequency; higher is the priority, while ties are broken arbitrarily.

The Rate Monotonic Analysis (RMA) is a technique that is used to determine schedulability of periodic tasks under the RM scheduling. The RMA can be classified into two broader categories: (a) inexact/imprecise tests (sufficient conditions) and (b) exact/precise tests (necessary and sufficient conditions). For real-time systems demanding low cpu utilization, imprecise tests may be a reasonable choice to determine feasibility. On the other hand, precise tests become inevitable when the workload is high (up to 100%). Because of its polynomial time complexity, imprecise tests are preferred over precise tests. On the contrary, the associated complexity with exact solution is high, which makes the aforementioned techniques impractical for online analysis. Attempts are being made to reduce the average-case time complexity of precise tests [2, 3, 4, 5, 6, 7, 8]. However, the complexity of these tests still remains pseudo-polynomial. Therefore, further research is needed to bridge the existing gap between polynomial and pseudo-polynomial tests.