

New Worst-Case Response Time Analysis Technique For Real-Time Transactions

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Abstract. In this paper, we present a new worst-case response time analysis technique for transactions scheduled by fixed priorities. In the general context of tasks with offsets (general transactions), only exponential methods are known to calculate the exact worst-case response time of a task. The known pseudo-polynomial techniques give an upper bound of the worst-case response time. The new analysis technique presented in this article gives a better (i.e. lower) pseudo-polynomial upper bound of worst-case response time. The main idea of this approach is to combine the principle of exact calculation and the principle of approximation calculation, in order to decrease the pessimism of Worst-case response time analysis, thus allowing to improve the upper bound of the response time provided while preserving a pseudo-polynomial complexity.

1 Introduction

The Response-Time Analysis (RTA) (Audsley et al., 1995) is an essential analysis technique that can be used to perform schedulability tests (i.e. testing if tasks in a system will meet their deadlines). Usually, the task model is an extension of the model of Liu and Layland (Liu and Layland, 1973). The schedulability conditions obtained with the model of (Liu and Layland, 1973) are however too pessimistic for certain kinds of pattern of tasks as tasks with offset (Tindell, 1992, 1994), serial transactions (Traore et al., 2006a), reverse transactions (Traore et al., 2006b), multiframe tasks (Mok and D.Chen, 1996) generalized multiframe tasks (Han and Yan, 1997)(Baruah et al., 1999).

Tindell proposed in (Tindell, 1994) a new model of tasks with offset (transactions) extending the model of Liu and Layland (Liu and Layland, 1973). Transactions are non-concrete (the transaction release times are not fixed a priori), thus the main problems is to determine the worst case configuration for a task under analysis (its critical instant). Offset-Based response time analysis of tasks scheduled under dynamic priorities EDF has been proposed in (Gutierrez and Harbour, 2003). In (Tindell, 1994, 1992) Tindell proposed an exact RTA technique for transactions scheduled by a fixed priorities scheduler, this exact method has an exponential complexity and is intractable for realistic task systems; In (Tindell, 1994) Tindell has pro-