

A C-space sensitivity analysis of Earliest Deadline First scheduling

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Abstract. This paper presents a sensitivity analysis for the dimensioning of real-time systems in which sporadic tasks are executed according to the preemptive Earliest Deadline First (EDF) scheduling policy. The timeliness constraints of the tasks are expressed in terms of late termination deadlines. A general case is considered, where the task deadlines are independent of the task sporadicity intervals (also called periods). New results for EDF are shown, which enable us to determine the C-space feasibility domain, such that any task set with its worst-case execution times in the C-space domain is feasible with EDF. We show that the C-space domain is convex, a property that can be used to reduce the number of inequalities characterizing the C-space domain.

1 Introduction

This paper considers the problem of correctly dimensioning real-time systems. The correct dimensioning of a real-time system strongly depends on the determination of the task Worst-Case Execution Times (WCETs). Based on the WCETs, a Feasibility Condition (FC) (1), (10), (5) can be established to ensure that the timeliness constraints of all the tasks are always met, regardless of their release times, when they are scheduled by either a fixed or a dynamic priority-driven preemptive scheduling algorithm. The timeliness constraints are expressed in terms of late termination deadlines imposed on the completion times of the tasks. The task model is the classical sporadic model. A sporadic task set $\tau = \{\tau_1, \dots, \tau_n\}$ is composed of n sporadic tasks, where a sporadic task τ_i is defined by:

- x_i : its worst-case execution time (WCET).
- T_i : its minimum inter-arrival time (also called, by extension, the period).
- D_i : its relative deadline (a task released at time t must be executed by its absolute deadline $t + D_i$).

In the sequel, we assume the general case where deadlines and periods are independent.