# SUMMARY OF Ph.D. DISSERTATION

| School<br>Science for Open and Environmental Systems | Student Identification Number | SURNAME, First name<br>KOBAYASHI, Hidenori |
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Title

Real-Time Scheduling of Practical Imprecise Tasks under Transient and Persistent Overload


Abstract

The real-time computing community has developed scheduling techniques that overly reserve resources for the worst case scenario. Adopting these techniques in a dynamic real-time system leads to low effective processor utilization. The research presented herein considers both theoretical and practical aspects of imprecise computing to enable construction of theoretically overloaded real-time systems. The thesis established in the research is that systematic real-time scheduling of practical imprecise tasks evicts overprovisioning of resources and increases the effective processor utilization without causing a critical timing violation.

The dissertation first presents a practical imprecise computation model that enables compensation for terminated optional parts. Computations based on this model are represented by a linear task model in order to assess their feasibility in a polynomial time. Two scheduling algorithms are developed for two different types of overload. The M-FWP algorithm is targeted at transient overload caused by activation of aperiodic tasks. It maximizes the acceptance ratio of aperiodic tasks and resolves the overload in a short period of time. The SS-OP algorithm is targeted at persistent overload caused by activation of periodic tasks. It maximizes Quality-of-Service (QoS) of the whole task set and avoids drastic changes in the QoS of each periodic task. Both algorithms allow tasks to dynamically reserve computation time to prevent premature termination of optional parts with 0/1 constraints. The effectiveness of the scheduling algorithms is studied by two sets of simulations that model systems of transient and persistent overload. Moreover, the practicality of the whole approach is validated by developing an embedded real-time operating system and by implementing required supporting mechanisms for practical imprecise tasks as well as the presented scheduling algorithms. The dissertation concludes that the presented approach serves the purpose of evicting unnecessary reservation of computation time and contributes to the development of cost effective real-time systems.