Energy-Aware Standby-Sparing for Real-Time Systems with QoS-Constraints

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Abstract:
For real-time embedded systems, quality of service (QoS), energy conservation, and Fault tolerance are critical design issues. In this work, we focus on exploring methods that can simultaneously address the above three factors using standby-sparing. The standby-sparing mechanism adopts a dual-processor architecture in which each processor plays the role of the backup for the other one dynamically. In this way it can provide fault tolerance subject to both permanent and transient faults. Due to its duplicate executions of the real-time tasks, the energy consumption of a standby-sparing system could be quite high. With the purpose of reducing energy under standby-sparing, we proposed a novel scheduling scheme for real-time systems with QoS-constraint which requires that among any k consecutive jobs of a task at least m out of them must meet their deadlines. Through extensive evaluations and performance analysis, our results demonstrate that the proposed techniques are very promising in reducing energy consumption while assuring QoS-constraints for fault tolerance real-time systems using standby-sparing.

Keywords:
QoS, Energy conservation, Fault tolerance, Standby-sparing, Real-time scheduling.