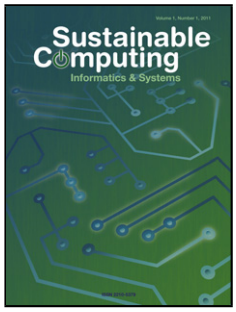

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Experimental Study of Energy and Time Constrained Task Scheduling with Irregular Speed and Power Levels

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Abstract – *We consider energy and time constrained scheduling of independent sequential tasks on a multiprocessor computer with bounded and discrete and irregular clock frequency and supply voltage and execution speed and power consumption levels. This is a very realistic power consumption model. However, it is very difficult to find useful information about the optimal solutions which are critical in evaluating the performance of heuristic algorithms. Our approach in this paper has two unique features. First, we develop algorithms that are applicable to all multiprocessor computers with bounded and discrete and irregular clock frequency and supply voltage and execution speed and power consumption levels. Second, we evaluate the performance of these algorithms on multiprocessors with a regular or close-to-regular power consumption model, for which, we have lower bounds for the optimal solutions. By using these lower bounds, we can perform both analytical study and experimental evaluation of the performance of our algorithms. We propose nine pre-power-determination algorithms for energy constrained scheduling; nine post-power-determination algorithms for energy constrained scheduling; nine pre-power-determination algorithms for time constrained scheduling; and nine post-power-determination algorithms for time constrained scheduling. The performance of these algorithms are evaluated analytically and also experimentally by comparing their solutions with optimal solutions, where the optimal solutions are obtained for regular or approximately regular power consumption models. We find that the combination of the largest execution requirement first method for task selection and the longest time first method for list scheduling yields the best performance.*

Keywords: Energy constrained scheduling, experimental performance study, irregular speed and power levels, time constrained scheduling.

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