多核系统基于遗传算法的实时任务节能映射

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摘 要：电压/频率岛（VFI）设计将多核处理器划分成 VFI，各 VFI 可设置独立的电压/频率，从而能进行灵活的功耗管理．针对 VFI 多核处理器上的实时任务应用，提出一种基于遗传算法的节能映射 GA-Mapping，将实时任务映射到计算核上调度运行，在满足任务实时性的前提下减小能耗．GA-Mapping 算法将任务的映射表示为字符编码串，并通过染色体的选择、交叉和变异算子的设计，在遗传迭代的过程中优化任务－计算核的映射，以减小系统能耗．通过实验将提出的算法与现有节能映射算法进行比较，实验结果表明，在节能与任务的可调度性方面，提出的算法均能获得较好的性能．

关键词：多核系统；实时调度；节能调度；遗传算法
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GA-Based Energy-Efficient Real-Time Task Mapping on Multi-Core Processors

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Abstract: In the VFI-based multi-core system, processing cores are partitioned into VFIs (voltage/frequency islands), so that the system is able to realize fine-grained power optimization by using a unique voltage/frequency for each VFI. In this paper, an energy-efficient mapping algorithm called GA-Mapping is presented, which is based on genetic algorithm, to map real-time tasks onto the processing cores in the VFI-based multi-core system. The proposed mapping algorithm converts the task-core mapping into digit string. Moreover, during the genetic process, the energy consumption is progressively optimized through the proposed selection, crossover and mutation operations. Experimental results demonstrate that compared with the existing energy-efficient mapping algorithms, the proposed algorithm has better performance with respect to energy efficiency as well as schedulability.

Key words: multi-core systems; real-time scheduling; energy-efficient scheduling, genetic algorithm

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