

**GERMANY/HONG KONG JOINT RESEARCH SCHEME**  
**THE PROJECT REPORT**  
*(for Project Completion)*

**Project Number:** G\_HK016/11

**Title**

Energy Efficient Schedules for Multi-core Architectures with Voltage Islands

**Particulars**

	Hong Kong team				German team	
Name of Project Co-ordinator (with title)	Dr. Minming Li				Dr. Jian-Jia Chen	
Name of Co-Investigator (if any)						
Institution or Institutional affiliation	<input checked="" type="checkbox"/>	CityU	<input type="checkbox"/>	HKU	<input type="checkbox"/>	University of _____
	<input type="checkbox"/>	CUHK	<input type="checkbox"/>	HKUST	<input type="checkbox"/>	
	<input type="checkbox"/>	HKBU	<input type="checkbox"/>	LU	<input checked="" type="checkbox"/>	Others: Karlsruhe Institute of Technology (KIT) _____
	<input type="checkbox"/>	HKIEd	<input type="checkbox"/>	PolyU	<input type="checkbox"/>	
Other project team members (if any)					Santiago Pagani	

**Funding Period**

	1 <sup>st</sup> year	2 <sup>nd</sup> year (if applicable)
Start Date	1 January, 2012	1 January, 2013
Completion Date	31 December, 2012	31 December, 2013

**Objective(s) as per original application**

1. Investigate the structure of min-energy schedules when all the sporadic tasks are already assigned to cores. Try to design polynomial time algorithms to calculate the min-energy schedule for some representative classes of tasks. We will also explore the online setting and try to design online algorithms with good performance.
2. Study the above objective when the voltage islands are non-disjoint.
3. Extend the study to periodic tasks, with the goal of reducing the energy consumption in the task schedule that satisfies the time requirements of all the tasks.

**Details of Report** [Please attach relevant document(s)]

**i) Outline of proposed research and results obtained**

Throughout the two years, we have conducted research as proposed in the proposal and have obtained nice algorithmic solutions for energy efficient schedules on multicore systems with voltage islands. Simulations on the real Intel SCC platform also validated the efficiency of our algorithms. We also extended our research to the dark silicon problem which mainly deals with the temperature constraint in a local area of the chip.

**ii) Significance of research results**

The results (both theoretically and experimentally) add insightful understanding of the energy efficiency issues in multicore system with voltage islands.

**iii) Research output**

Santiago Pagani, Jian-Jia Chen, Minming Li  
Energy Efficiency on Multi-core Architectures with Multiple Voltage Islands,  
accepted by IEEE Transactions on Parallel and Distributed Systems.

**iv) Potential for or impact on further research collaboration**

The Hong Kong PI and German PI continue their collaboration after the project finishes. This year, the Hong Kong PI is going to visit the German PI again in the summer. The travel grant has made an important impact on the establishment of the research collaboration.