

**CHENNAI – PONDICHERRY**

**EXPLORING HETEROGENEITY WITHIN A CORE FOR IMPROVED**

**POWER EFFICIENCY**

**ABSTRACT**

Asymmetric multi-core processors (AMPs) comprise cores with different sizes of micro-architectural resources yielding very different performance and energy characteristics. Since the computational demands of workloads vary from one task to the other, AMPs can often provide a higher power efficiency than symmetric multi-cores. Furthermore, as the computational demands of a task change during its course of execution, reassigning the task from one core to another, where it can run more efficiently, can further improve the overall power efficiency. However, too frequent re-assignments of tasks to cores may result in high overhead. To greatly reduce this overhead, we propose a morphable core architecture that can dynamically adapt its resource sizes, operating frequency and voltage to assume one of four possible core configurations. Such a morphable architecture allows more frequent task to core configuration re-assignments for a better match between the current needs of the task and the available resources. To make the online morphing decisions we have developed a runtime analysis scheme that uses hardware performance counters. Our results indicate that the proposed morphable architecture controlled by the runtime management scheme, can improve the throughput/Watt of applications by 31 percent over executing on a static out-of-order core while the previously proposed big/little morphable architecture achieves only a 17 percent improvement.