Embedded Redundancy Management for Low-Cost, Safety-Critical Systems
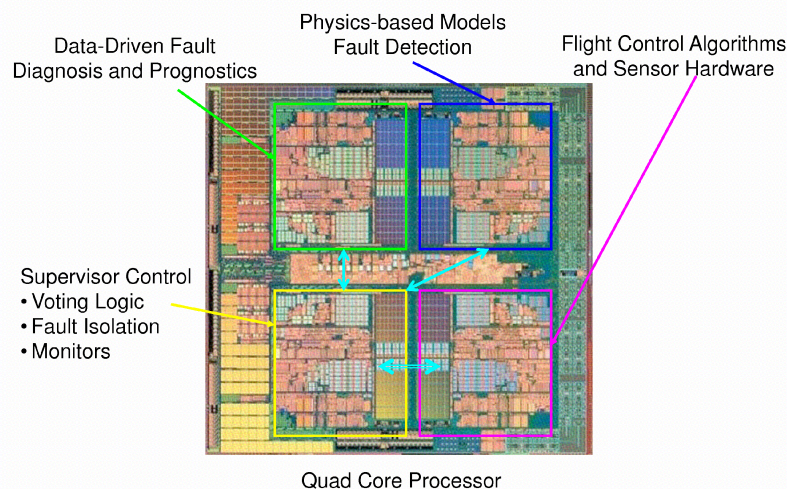
Seiler, Balas, Heimdahl, Srivastava, and Zhai

Issue: Current safety critical systems rely mainly on physical redundancy, increases system size, complexity and power.

Objective: Develop algorithms and computing architectures which enable fault detection without relying on physical redundancy.

Fault Detection Approach

1. *Model-based monitors* to detect faults in physical domain
2. *Monitors derived from software requirements* to detect faults in cyber (hardware/software) domain
3. *Data-driven anomaly detection* to cyber/physical faults

Data-Driven Fault Diagnosis and Prognostics

Physics-based Models Fault Detection

Flight Control Algorithms and Sensor Hardware

Supervisor Control
• Voting Logic
• Fault Isolation
• Monitors

Quad Core Processor

Computing Architectures:
• Multi-core architectures
Applications:
• UAVs, medical devices, road vehicles