PCM-BASED COOLING

Joseph Carlos
Elon Bauer
OUTLINE

• Motivation
• Literature Review
• Methodology
• Progress
• Milestones
**MOTIVATION**

- Current generation heat sinks are inefficient
- Require the use of active cooling to disperse heat
- Heat is output as waste into the environment
- PCMs undergo phase changes
  - Increased heat input does not increase heat output
- Could be used as an effective heat sink without active cooling
  - Thus reducing power consumption
MOTIVATION
LITERATURE REVIEW

• Wang & Baldea
  • Control theory regarding a PCM-based heat sink
  • Used with and without active cooling
  • Used mathematical models to get promising results

• Kandasamy, Wang, & Mujumdar
  • Researched paraffin wax
  • Developed numerical models using empirical data
LITERATURE REVIEW

• Rostamizadeh et al.
  • Theoretical model for PCM using first principals
  • Validated using calcium chloride hexahydrate

• None of these cover how different workloads might affect the PCM vs. conventional methods

• There is also little exploration into the different types of PCMs which are available
Methodology

• Consider different types of PCMs
  • Solid-liquid phase change is of greatest interest
  • Organic, inorganic, eutectic, hygroscopic
  • Tradeoffs in melting point and phase change duration

• Use HotSpot to create a thermal profile
  • Reduce the size of the heat sink and use PCM to fill the gap

• Consider which PCMs are best for which applications
• Attempts to simulate a PCM transfer function were thwarted by faulty math in papers

• Have a list of 100+ PCMs with melting points and specific heats

• Have preliminary function showing PCM temperature profile
PROGRESS
MILESTONES

• Generate temperature profiles using HotSpot

• Use PCM model to determine effectiveness of PCM-based cooling on various workloads

• Repeat for various different PCMs to determine desired characteristics under different workloads