

## 14. Thermal Management of Electronics

**Course Leader:** *Jaime Sanchez – Intel Corporation*

### **Course Objective:**

This course provides the fundamentals of heat transfer applied to the design of thermal systems used to cool electronic components with an emphasis in semiconductor packages. We start with the basic theory of heat transfer and demonstrate simple concepts used today to calculate the cooling requirements for an electronic package and the impact of various parameters on the electronic package. This course covers in-depth heat transfer theory and analysis to give the student a comprehensive understanding of the key modes of heat transfer and their applications. Practical topics such as thermal interface materials, heat sink design and advanced cooling techniques are reviewed.

### **Course Outline:**

1. Fundamentals of Heat Transfer and Its Application to Electronics Cooling
2. Techniques to Determine Cooling Requirements for a Package and Impact of Boundary Conditions
3. Simplification of Heat Transfer Equations to Analyze Cooling Solutions
4. Governing Principles of Cooling Solutions
5. Application of Numerical Methods to Calculate the Performance of Cooling Solutions
6. Introduction to Thermal Interface Materials and Their Applications
7. Techniques to Size Cooling Requirements and Trade-Offs
8. Parameters that Impact the Performance of Cooling Solutions
9. Introduction to Experimental Characterization of Cooling Solutions and Instrumentation
10. Fan Selection

### **Who Should Attend:**

This class is intended for senior undergraduate and graduate students, as well as engineers working in the field of thermal management.

### **BIO:**

**Jaime Sanchez** is a Technologist at Intel Corporation in Oregon. He has a Ph.D. in Mechanical Engineering from the University of Kentucky and is a licensed Professional Engineer. He joined Intel in 2008 and has worked in research and development for test equipment and thermal tools used in high volume manufacturing and silicon validation as well as data center cooling solutions for high-end server products. He is currently part of the wafer sort group supporting Intel's product roadmap. He is also an adjunct faculty in the Mechanical and Materials Engineering Department at Portland State University where he teaches thermodynamics and heat transfer.