16. Thermal Spreading and Contact Resistance

Course Leaders: Yuri Muzychka – Memorial University of Newfoundland and Marc Hodes – Tufts University

Course Description:
This course will mainly focus on fundamentals and applications of thermal spreading and contact resistance for thermal management in electronics packaging. The course will be based in part on the new text Thermal Spreading and Contact Resistance, by Y. Muzychka and M. Yovanovich, Wiley, 2023. The last part of the course will discuss analytical techniques relevant to the modeling of thermoelectric modules, micro-devices, thermal interface materials (TIMs), heat sinks and heat pipes, to complement the core material on spreading and contact resistance, providing a holistic view of the power of analysis in thermal design.

Course Outline:

1. Introduction
2. Thermal Spreading (Constriction) Resistances
3. Semi-Infinite, Finite Domains, and Multi-Component Systems
4. Thermal Spreaders With Isotropic, Compound, and Orthotropic Materials
5. Single and Multi-Source Systems
6. Non-Uniform Conductance in Heat Sinks
7. Interface Materials
8. Thermal Contact Resistance of Rough Conforming and/or Non-Conforming Surfaces
9. Simple Models
10. Spreading Resistance in Domains With Surface Roughness
11. Role of Spreading Resistance in Flows Over Superhydrophobic Surfaces
12. Practical Examples and Case Studies
13. Analysis Relevant to Thermoelectric Modules, Heat Sinks and Heat Pipes

Who Should Attend:
Mechanical and electrical engineers working in thermal management of electronics packaging at device level, package level, or system level. Both experienced applications engineers and newcomers to the field will benefit from participation in the proposed short course, as will academics doing research in the field.

Bio 1: Yuri Muzychka is a Professor of Mechanical Engineering at Memorial University of Newfoundland (Canada). He joined the Faculty of Engineering and Applied Science at Memorial University of Newfoundland in 2000. He completed his PhD in 1999 at the University of Waterloo. Since joining Memorial University, he has focused his research efforts in several areas of heat transfer and fluid dynamics, namely: fundamentals of convection and conduction heat transfer, thermal management in electronics, transport phenomena in internal flows, multiphase phase flow, and most recently marine icing phenomena. He has published over 250 papers in high quality journals and international conference proceedings, 3 handbook chapters, and 1 book. He is a Fellow of the ASME.

Bio 2: Marc Hodes is a Professor of Mechanical Engineering at Tufts University. He completed his PhD at MIT in the Heat Transfer Laboratory in 1998. He then spent 10 years at Bell Labs on R&D related to heat transfer in a telecommunications context. Current research is focused on aerogels, diabatic superhydrophobic surfaces, heat sinks and heat pipes.