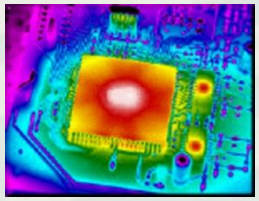


Numerical Modeling of 3D Vapor Chambers

Faculty: J. Y. Murthy, S. V. Garimella Student: Ram Ranjan

Objective

Develop physics-based numerical models to determine the dry-out of vapor chamber heat spreaders for different wick structures.

Impact

- Micro-level effects (thin-film evaporation, Marangoni convection) are captured in the vapor chamber model.
- Vapor chamber performance with different wick structures can be predicted using the coupled model.

Approach

Couple Evaporation Micromodel with Vapor Chamber 3D Model

Macromodel[1]

Compute pressure gradient across interface in the device

Evaporation Micromodel[3]

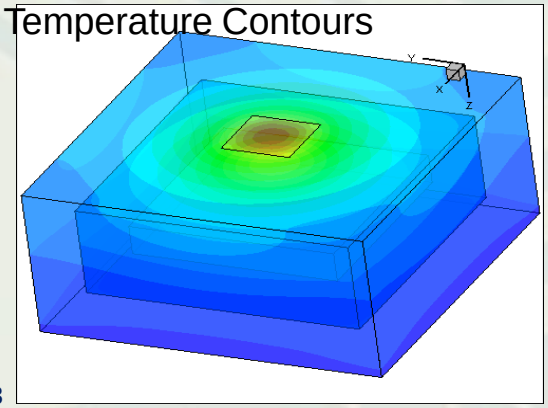
Compute interfacial mass transfer coefficient including thin-film evaporation and Marangoni effects

Surface Evolver Model[2]

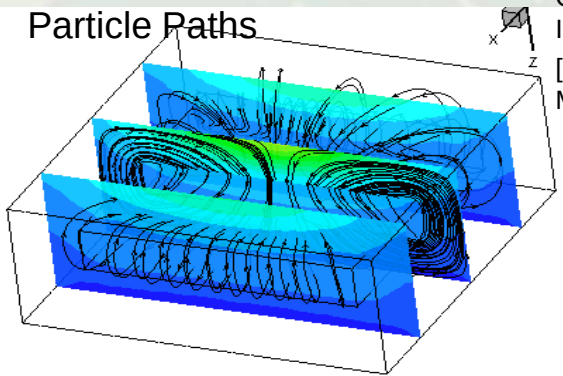
Get corresponding contact angle from Surface Evolver model

3D Vapor Chamber Simulation Results

Temperature Contours



Particle Paths



Selected Publications

[1] R. Ranjan, J. Y. Murthy and S. V. Garimella, 2010 ITHERM Conference, Paper no. ITHERM10-2586..

[2] R. Ranjan, J. Y. Murthy and S. V. Garimella, ASME JHT, 2009, vol. 131, 101001.

[3] R. Ranjan, J. Y. Murthy and S. V. Garimella, ASME IMECE 2009, Paper no. IMECE09-11326.

[4] U. Vadakkan, S. V. Garimella and J. Y. Murthy, ASME JHT, 2004, vol. 126, 347-354.

PURDUE UNIVERSITY

COOLING TECHNOLOGIES RESEARCH CENTER