A Validated Time-Stepping Analytical Model for 3D Transient Vapor Chamber Transport

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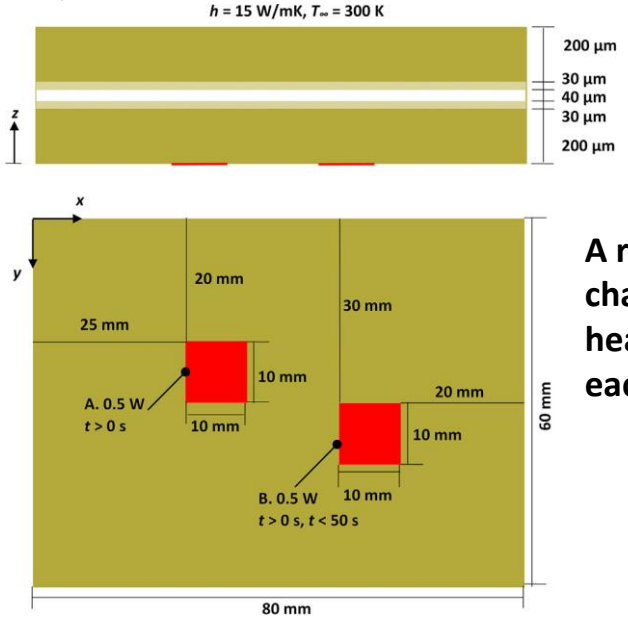
Motivation

- Highly effective heat spreading is needed in portable electronic devices to mitigate transient hotspots.
- While thin vapor chambers provide extreme heat spreading performance potential, their transient thermal behavior in response to dynamic heating conditions was previously not well understood.

Highlights

- A first-of-its-kind analytical model was developed that simulates the transient thermal behavior of thin vapor chambers.
- Model capable of handling multiple, arbitrary shaped, time varying heat inputs on rectangular vapor chambers
- Model has a good accuracy as compared to a finite-volume based model, along with a 3-4 orders of magnitude reduction in computational cost.

G. Patankar, J. A. Weibel and S. V. Garimella, "A Validated Time-Stepping Analytical Model for 3D Transient Vapor Chamber Transport", IJHMT, vol. 119, pp. 867-879, 2018.



A rectangular vapor chamber with two heat inputs of 0.5 W each (Left).

Predicted temperature contours at time *t* = 47 s, with a cut section through heater A (Bottom)