A Design-Centered Approach to NanoEngineering

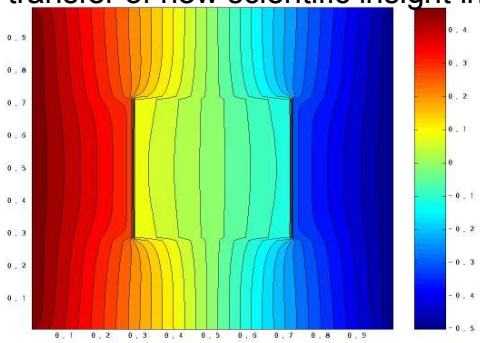
Kurt Maute, Martin L. Dunn and Ronggui Yang
National Science Foundation
$330,000 09/2007-08/2010

Rationale: Macroscopic modeling and analysis methods are inaccurate, and existing nanoscale approaches are inadequate for design purposes.

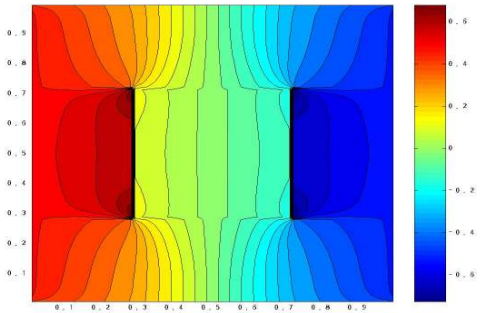
Objectives: Computational analysis methods will be developed for predicting the performance of nanostructures and their sensitivity with respect to design and uncertainty parameters.

Application Drivers: (a) the design of novel thermoelectric materials for energy harvesting and electronic refrigeration, and (b) the design of optimal thermal management systems for next-generation 3-D microchips.

Impacts: The proposed design framework will foster a push-pull interaction between scientists and engineers that will enable the rapid transfer of new scientific insight into novel engineering designs and products.

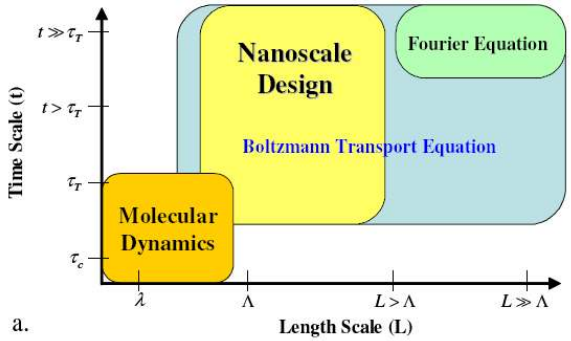


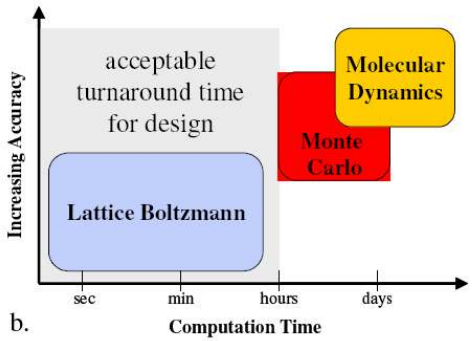
Macro composite



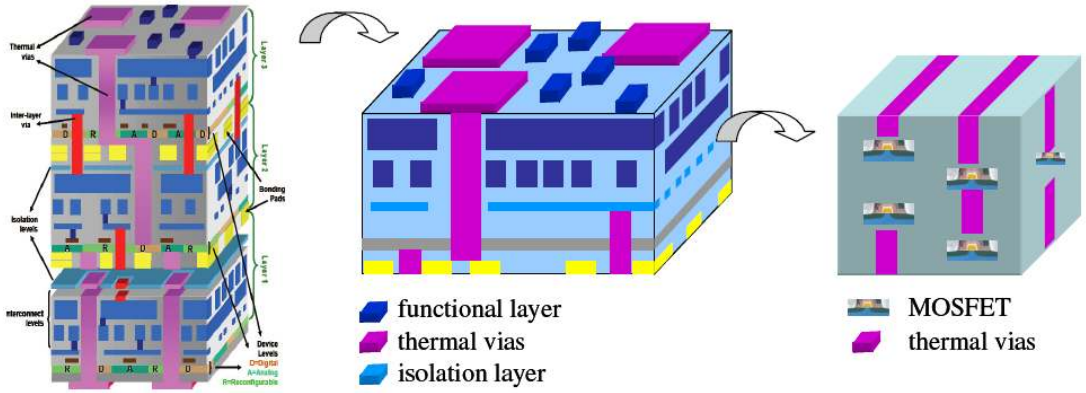
Nano composite

Thermal transport in nanostructures is significantly dufferent from that in nanoscale





Kinetic theory based deign tool to be developed will have acceptable turnaround time but reasonable accuracy that captures nano-physics.



a. 3D chip b. sub-millimeter scale design c. nano scale design