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Thermal management of multi-chip module and printed circuit board using FEM and genetic algorithms

Abstract

Purpose - To determine the optimal chip/component placement for multi-chip module (MCM) and printed circuit board (PCB) under thermal constraint. Design/methodology/approach - The placement of power dissipating chips/component is carried out using genetic algorithms (GA) in order to achieve uniform thermal distribution on MCM and PCB. The thermal distribution on the MCM and PCB are predicted using 2D-finite element method (FEM) analysis. Different number of chip/component and FEM meshing size is used to investigate the placement of chips/components. Findings - The optimal placement of chip/component using GA is compared well to other placement techniques. The coarse meshing for FEM employed here is found adequate to carry out optimal placement of components by GA. Research limitations/implications - The analysis is valid for constant properties of MCM or PCB and steady state conditions. The chip/component size is limited to a single standard size. Practical implications - The method is very useful for practical design of chip/component placement on MCM/PCB under thermal consideration. Originality/value - FEM analyses of MCM and PCB can be easily implemented in the optimization procedure for obtaining the optimal chip/component placement based on thermal constraints.

Keywords — Finite element analysis, printed-circuit boards, programming and algorithm theory