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Heat transfer and deformation analysis of flexible printed circuit board under thermal and flow effects

Abstract

Purpose: The purpose of this study is to investigate heat transfer and deformation of flexible printed circuit board (FPCB) under thermal and flow effects by using fluid structure interaction. This study simulate the electronic cooling process when electronic devices are generating heat during operation at FPCB under force convection.
Design/methodology/approach: The thermal and flow effects on FPCB with attached ball grid array (BGA) packages have been investigated in the simulation. Effects of Reynolds number (Re), number of BGA packages attached, power supplied to the BGA packages and size of FPCB were studied. The responses in the present study are the deflection/length of FPCB (δ/L) and Nusselt number (Nu). Findings: It is important to consider both thermal and flow effects at the same time for understanding the characteristic of FPCB attached with BGA under operating condition. Empirical correlation equations of Re, Prandtl number (Pr), δ/L and Nu have been established, in which the highest effect is of Re, followed by Pr and δ/L. The δ/L and (Formula presented.) were found to be significantly affected by most of the parametric factors. Practical implications: This study provides a better understanding of the process control in FPCB assembly. Originality/value: This study provides fundamental guidelines and references for the thermal coupling modelling to address reliability issues in FPCB design. It also increases the understanding of FPCB and BGA joint issues to achieve high reliability in microelectronic design.

Keywords

BGA; CFD; Electronic cooling; Empirical correlation equations; Flexible printed circuit board