 ICCES, vol.11, no.1, pp.5-5

A three-dimensional meshless scheme with background grid for electrostatic-structural analysis

Ming-Hsiao Lee[1,2], Wen-Hwa Chen[1], Yu-Ching Shih[2]

Summary

In the electrostatic-structural problems as encountered in many electrostatic driven MEMS devices, the electrostatic analysis domain is often extremely distorted due to the deflection of the structure. This kind of problem is difficult to deal with by almost all kinds of available numerical methods. A new three-dimensional meshless scheme with background grid is thus proposed herein to solve those difficulties in numerical simulations.

By this scheme, a three-dimensional fixed background grid with regularly-distributed nodes is utilized. Another set of discretized boundary grid is employed to describe both the surface boundaries of the structure and the electrostatic field. The analysis domains are modeled by the nodes which are from the surface boundary grid and the background grid enclosed by the surface boundary. During the incremental solution process, when the surface boundary of the structure moves, those boundary nodes remain the same, while the internal nodes for the electrostatic field analysis may be re-selected from the fixed background grid according to the movement of the surface boundary. Hence, no matter how large the surface boundary moves, regularly distributed internal nodes taken from the fixed background grid are gained and the distortion of the analysis model is minimized. Therefore, the whole solution process can be automatically handled by the scheme developed without any intervening modeling, e.g. remeshing or rezoning. Several cases of electrostatic-structural coupled problems are tackled in this work to demonstrate the effectiveness and advantages of the novel meshless scheme. As a result, an effective computation procedure is implemented.

keywords: Meshless, Electrostatic-structural analysis, Background Grid

[1]Department of Power Mech. Engng., National Tsing Hua University, Hsinchu, Taiwan, ROC
[2]National Center for High-performance Computing, Hsinchu, Taiwan, ROC. mhlee@nchc.org.tw