

## Design Evaluation of an Electronic Contactor

### BACKGROUND

Ball grid array soldering is commonly used to provide electrical contact points for integrated circuit boards. For mass production quality control, a test device must quickly create effective contact on the ball grid while flexibly conforming to variations in ball size without damage.

Most current testing devices use an array of complex and expensive spring-loaded contacts (Fig. 1). In search of a simpler, yet reliable, electronic contact, a manufacturer of electronic test equipment commissioned

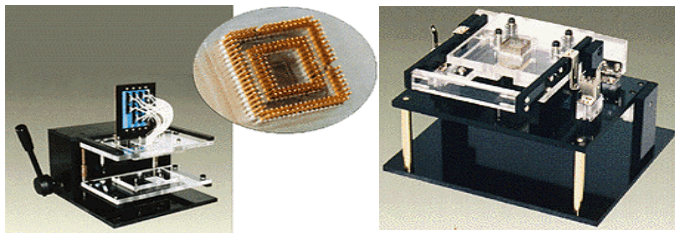


Figure 1: Two current Ball Grid Array Testing Devices

MIS to perform finite element stress analysis of their latest proprietary designs. These designs were inspired by a new electroforming process that creates small metal parts with superior mechanical properties.

### DISCUSSION

The client defined operating characteristics, loading schemes, and criteria for acceptability. MIS worked with the client and the material supplier to identify loading variations and the required testing to identify material properties necessary for the evaluation. Variation in ball sizes was identified as being a major challenge for the

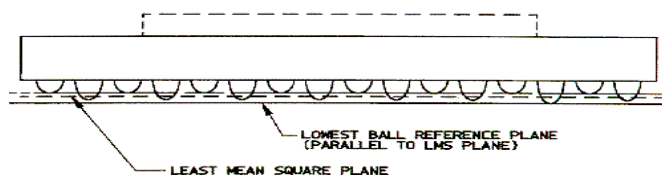


Figure 2: Variation in ball sizes (after JEDEC Standards)

device (Fig. 2).

To evaluate the designs, MIS created 3D finite element models of various embodiments of the contactor design. Each model was analyzed for a wide range of loading conditions simulating required contact forces and variations in ball contact sizes. This work included non-linear analysis using large deformation formulations. Stress and deflection conditions for each design were obtained (Fig. 3) and were compared to material properties (e.g. fatigue strengths). Improvements in various designs and alternative embodiments were identified by MIS to better the performance of each

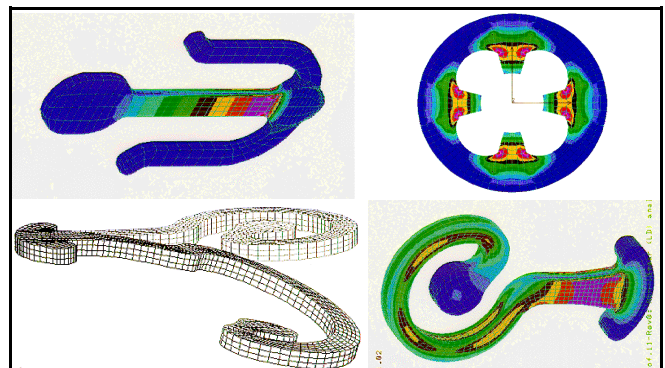


Figure 3: Non-linear stress contour & deformation plots for some of the design embodiments

design.

### CONCLUSION

MIS worked with the client to identify and analyze various embodiments of their proprietary design for a new contacting device under the required ranges of forces and deflections. Our expertise in material engineering, stress analysis, and finite element modeling helped our client to evaluate performance and acceptability of each design prior to manufacturing the devices. This allowed them to identify improvements to better each design and lead to time and cost savings in manufacturing and product development.