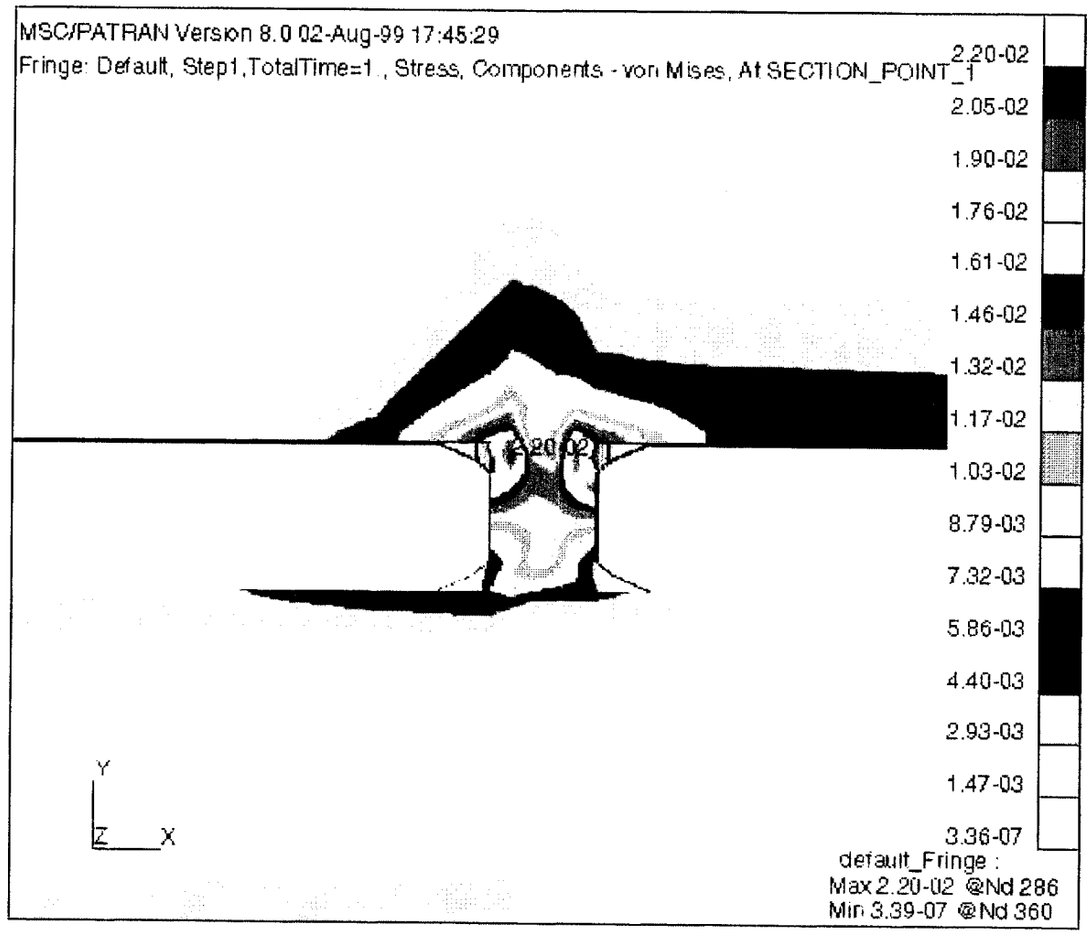
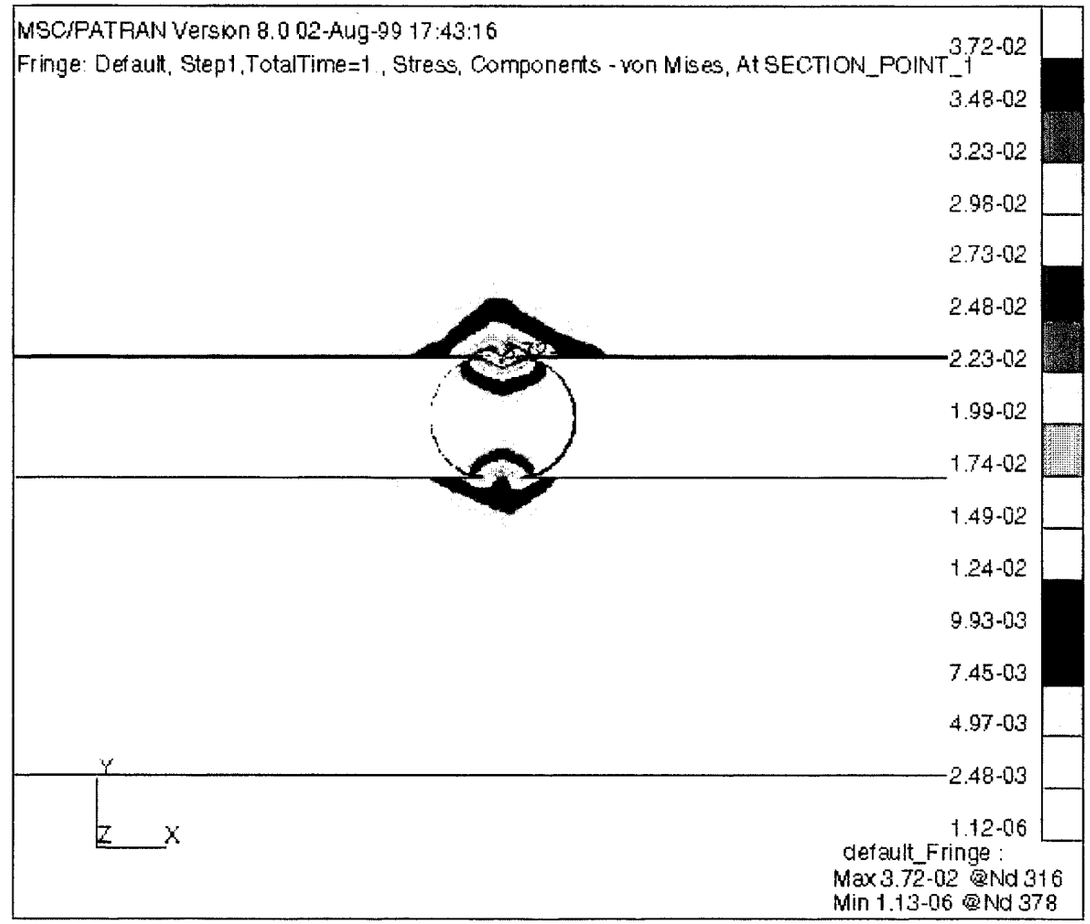
FEA Stress Analysis for the Comparison of BGA and CGA

Dr. Mark Fan

August 1999

During the design for the Nanosat Stacked MCM, support was provided regarding the reliability of BGA and CGA attachment methods so that an informed selection could be made by the designer. The attachment methods were considered in light of safety margin in terms of fatigue life. FEA techniques were used to model the two interconnect scenarios. Two FEA models were created to represent the actual sizes of BGA (30 mil solder ball) and CGA (25 mil height and 18 mil diameter). A cyclic thermal load (from 23 C to 100 C) was applied to both FEA models to solve for thermally induced stresses. While both interconnects can survive such a nominal thermal load, the highest von Mises stress in the CGA is lower than that in the BGA by a factor of 1.69. Thus, we recommended CGA be the choice for this MCM device. The FEA plots are attached for both the CGA and BGA considered.


MSC/PATRAN Version 8.0 02-Aug-99 17:45:29
Fringe: Default, Step1,TotalTime=1 , Stress, Components - von Mises, At SECTION_POINT_1
2.20-02
2.05-02
1.90-02
1.76-02
1.61-02
1.46-02
1.32-02
1.17-02
1.03-02
8.79-03
7.32-03
5.86-03
4.40-03
2.93-03
1.47-03
3.36-07
Y
Z
X
default_Fringe :
Max 2.20-02 @Nd 286
Min 3.39-07 @Nd 360


MSC/PATRAN Version 8.0 02-Aug-99 17:43:16
Fringe: Default, Step1,TotalTime=1 , Stress, Components - von Mises, At SECTION_POINT_1
3.72-02
3.48-02
3.23-02
2.98-02
2.73-02
2.48-02
2.23-02
1.99-02
1.74-02
1.49-02
1.24-02
9.93-03
7.45-03
4.97-03
2.48-03
1.12-06
Y
Z
X
default_Fringe :
Max 3.72-02 @Nd 316
Min 1.13-06 @Nd 378