

Fermilab

PPD/MD/Engineering Analysis Group

A Buckling Analysis for 8 Planes (Empty)

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A buckling stability calculation is done for an 8 planes (empty case) with different glue area coverage. Both “non-linear large deflection” and “eigenvalue (classical solution)” are used for the purpose of the comparison as shown in Table 1. It seems that the result is very compatible.

Table 1 The Buckling Calculation for the 8 planes (empty case)

8 planes __ empty	SF (non-linear analysis)	SF (eigenvalue solution)
100% glue	3.1	3
50% glue	2.9	2.86
25 % glue	2.7	2.79

The model has 8 planes with “top free” and “bottom fixed” boundary condition. The non-linear larger deflection analysis is to load the structure up to a point where it becomes unstable, or the structure reaches its maximum load carrying capacity. Its displacement or deflection increased rapidly and the solution is diverged as seen from the attachment. It is considered to be more accurate than eigenvalue solution, depending upon the structure and load in question.

Appendix:

The Load vs displacement curve for the non-linear buckling solution

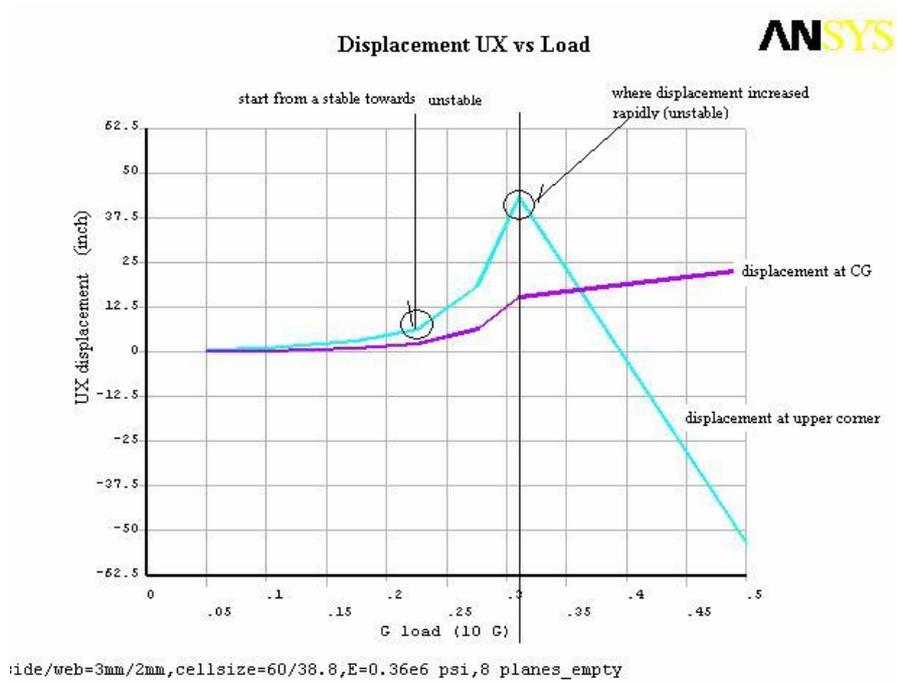


Fig 1 The displacement UX at top verse it's the G load for 100% glue coverage

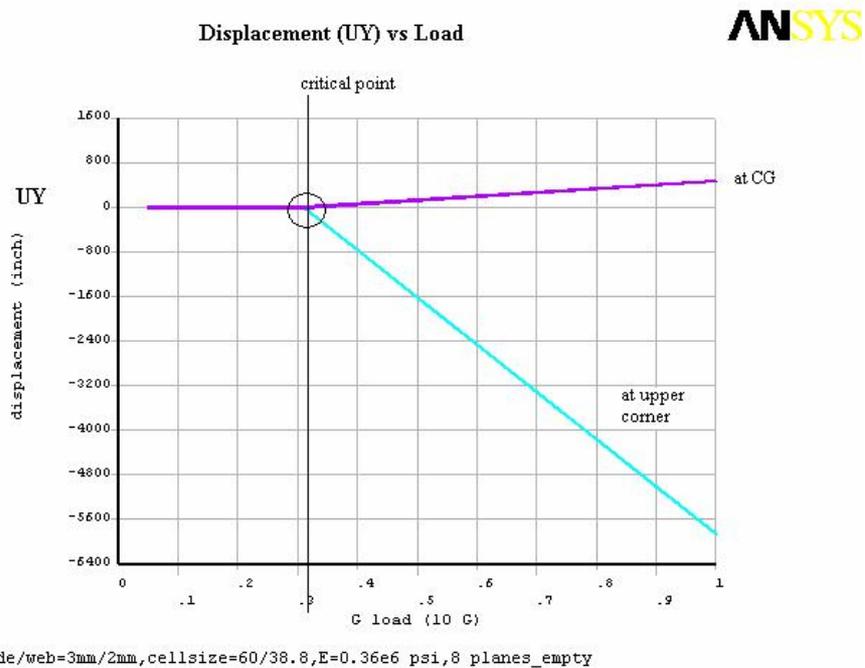
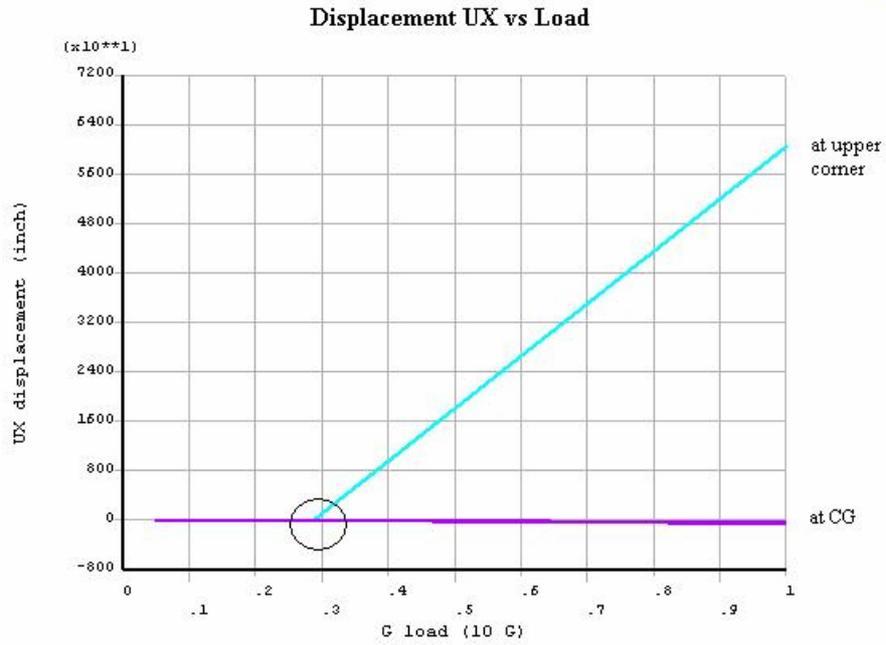
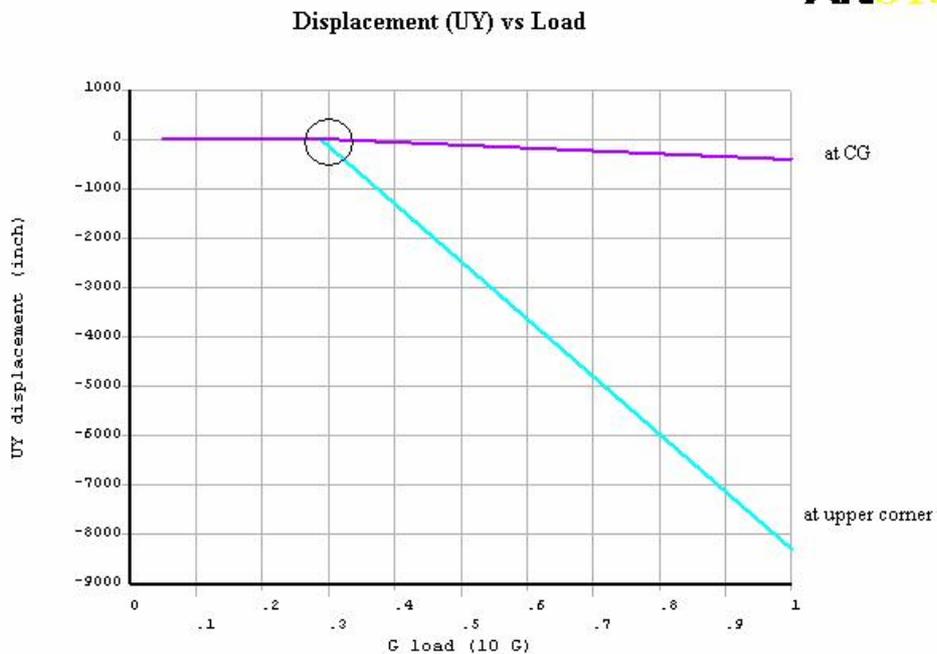


Fig 2 The displacement UY at top verse it's the G load for 100% glue coverage



side/web=3mm/2mm,cellsize=60/38.8,E=0.36e6 psi,8 planes_empty,50% glue

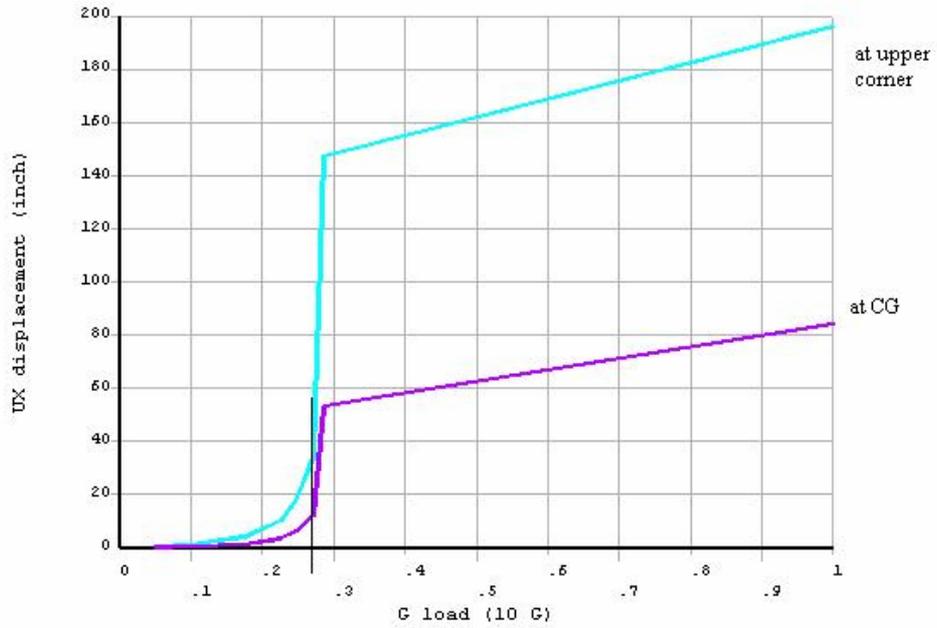
Fig 3The displacement UX at top verse it's the G load for 50% glue coverage



side/web=3mm/2mm,cellsize=60/38.8,E=0.36e6 psi,8 planes_empty,50% glue

Fig 4The displacement UY at top verse it's the G load for 50% glue coverage

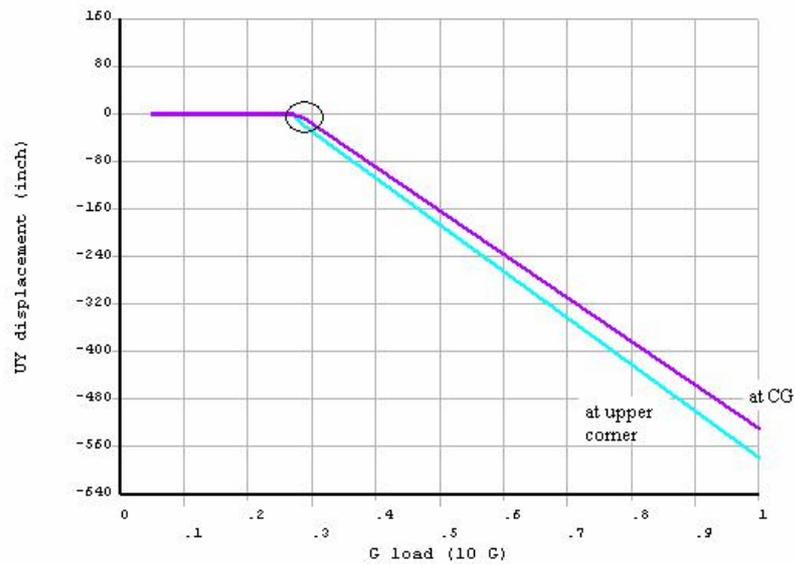
Displacement UX vs load



side/web=3mm/2mm,cellsize=60/38.8,E=0.36e6 psi,8 planes_empty,25% glue

Fig 5 The displacement UX at top verse it's the G load for 25% glue coverage

Displacement UY vx Load



side/web=3mm/2mm,cellsize=60/38.8,E=0.36e6 psi,8 planes_empty,25% glue

Fig 6 The displacement Uy at top verse it's the G load for 25% glue coverage