

Verification of EFE on a Fixed Square Metallic Plate

This problem is identical to the Fox Problem except in the yield criterion. For the metallic plate the von Mises yield criterion is used as opposed to the Nielsen criterion used for reinforced concrete. The plate is fixed around the perimeter and loaded with a UDL. It is a problem that does not have a theoretically exact solution for the load factor. Although the yield line solution is shown as an upper-bound solution, it should be realised that the YL method uses the Nielsen yield criterion and so will not converge to the same solution as the UB approach.

Uniformly refined structured meshes of $n \times n \times 4$ elements were used for the analysis starting with $n=1$. Yield line (upper-bound) solutions were generated together with lower-bound solutions and the convergence of the load factor, in terms of percentage error, is presented in figure 1.

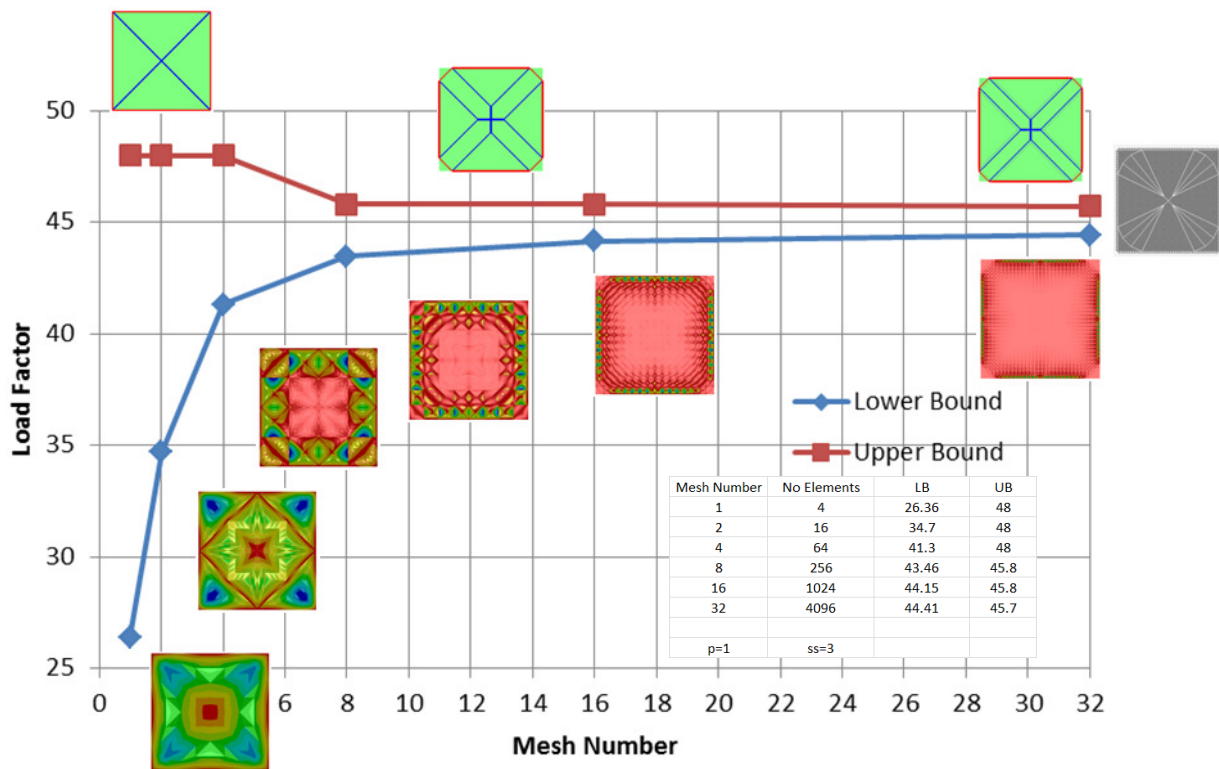


Figure 1: Convergence of Load Factor for Upper-Bound and Lower-Bound Solutions

The figure includes images of the yield line pattern for the upper-bound solution and utilisation for the lower-bound solution. There are a number of published numerical solutions for this problem and these will be compared with the results from EFE in due course. If the utilisation is compared for the Nielsen and von Mises yield criteria then it is seen that the utilisation for the metallic plate is more uniform and this might be the reason that the metallic plate can take a greater load than the equivalent reinforced concrete slab.