

Computer generated structures and plastic collapse mechanisms: developments in Layout Optimization

Colin Smith, Senior Lecturer, University of Sheffield UK

Summary

Layout Optimization (LO) is a well established numerical technique utilized to optimize trusses and frames starting from a discrete grid of nodal positions. In layman's terms the method 'designs' optimal structures from nothing – only requiring the location of supports, loads and the allowable design domain.

The introduction to the presentation will give a brief overview of the theory behind LO including recent work at Sheffield that has dramatically increased the size of tractable problems. Practical examples of optimal truss design will be given for a range of cases.

More recently, joint work by the presenter has developed a whole new area in this field: Discontinuity Layout Optimization (DLO). This method permits, for the first time, the automatic identification of optimal plastic collapse mechanisms based on discrete sliplines or discontinuities. The second part of the presentation will present the theoretical breakthrough made in developing LO into DLO together with practical examples of application in metal forming, geotechnical analysis and slab yield line analysis.

The presentation should be of interest to structural and geotechnical engineers alike.