

Application of layout optimization methods in engineering analysis and design

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To verify the safety of solid bodies and structures against collapse, engineers have traditionally had to rely either on simplistic hand type calculations, or on significantly more complex computational tools which identify the collapse state in an indirect, iterative, manner - which can be costly in terms of computer and/or operator time. Additionally, in many engineering disciplines the initial design stage is carried out in an ad-hoc manner, with engineering intuition often used to identify structurally efficient designs. Direct analysis and design methods can potentially address both these issues, and similarities between analysis and design formulations can also potentially be exploited. Here the so-called 'layout optimization' technique is described, and then applied to truss and grillage design problems and to engineering analysis problems involving identification of the critical layout of discontinuities in solid bodies at the point of collapse. In each case mathematical programming techniques can be used to obtain solutions and it is observed that highly accurate solutions can be obtained rapidly, permitting new insights to be drawn in a range of application areas. Future directions in the field of layout optimization will then be briefly considered.