# STRUCTURAL DESIGN OPTIMISATION BY DYNAMIC PROGRAMMING

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# Abstract

Previous methods of optimising structures have been unable to vary the geometry of the solutions, except in simple rather artificial problems. The present work describes how dynamic programming can be applied to the optimisation of pin-jointed structures, including geometry among the variables.

The present work begins with an investigation of a simple cantilever truss. It is shown that the problem of optimising the shape of this structure can be solved using dynamic programming; and some efficient solutions are produced. Several generalisations of this problem are then discussed: asymmetry, non-vertical loading, arbitrary geometrical limitations, alternative loading systems, realistic strut design, other panel geometries. It is shown that most of these features can be handled by dynamic programming. The solutions obtained for the generalised problem are more efficient that normal designs and attractive in appearance.

The remainder of the present work describes the optimisation of an electricity transmission tower. The existing methods of analysis and design are followed where possible. Most of the features of a tower can be incorporated rigorously into a dynamic programming optimisation. The method can solve problems which are too expensive for manual optimisation.

The results show that dynamic programming can be used to optimise some types of structure. Most practical design features can be incorporated, and the method shows advantages in scope and efficiency over other optimisation processes.