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WEERAPONG CHAISATITWANICH : OPTIMUM DESIGN OF NONLINEAR PLANE TRUSSES BY THE VIRTUAL WORK METHOD. THESIS ADVISOR : PROF.THAKSIN THEPCHATRI,Ph.D. 65pp. ISBN 974-635-151-6

By the Virtual Work Method, the development of an optimum design for geometrically nonlinear plane trusses subject to displacement, stress, buckling and slenderness ratio constraints is presented in this research. The member sensitivity index(SI) which is the index showing the importance of the member contributed to the total displacement can be evaluated. The material should be added to members with high SI and removed from members with low SI. Theoritically, the optimum design is obtained when all members have the same SI. In practice, however, strength and slenderness ratio limitations given by codes must be satisfied. Therefore, after the convergence is obtained, the solution is then rechecked according to specifications from two codes, i.e., AISC/ASD 1989 and AISC/LRFD 1994. The members will be adjusted if necessary.

The Newton-Raphson method is used for the geometrically nonlinear analysis by the direct stiffness method. Although the material behaves linearly, the response of the structure becomes nonlinear. Equilibrium equations and geometric stiffness of the element are formulated from the Castiglino's theorm. The iterative process is continued until displacements and compensating vector are less than 0.1%.

It has been found from this reseach that the Virtual Work Method is an effective method in the optimum design of geometrically nonlinear plane steel trusses. This method makes solution suitable, safe and the maximum displacement not exceed the design code requirements. The total volume obtained is approximately 0-11% more than that obtained by linear analysis.

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