

Periodic Topology and Size Optimization Design of Tower Crane Boom

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Abstract : In order to achieve the layout and size optimization of the web members of tower crane boom, a truss topology and cross section size optimization method based on continuum is proposed considering three typical working conditions. Firstly, the optimization model is established by replacing web members with web plates. And the web plates are divided into several sub-domains so that periodic soft kill option (SKO) method can be carried out for topology optimization of the slender boom. After getting the optimized topology of web plates, the optimized layout of web members is formed through extracting the principal stress distribution. Finally, using the web member radius as design variable, the boom compliance as objective and the material volume of the boom as constraint, the cross section size optimization mathematical model is established. The size optimization criterion is deduced from the mathematical model by Lagrange multiplier method and Kuhn-Tucker condition. By comparing the original boom with the optimal boom, it is identified that this optimization method can effectively lighten the boom and improve its performance.

Keywords : tower crane boom, topology optimization, size optimization, periodic, SKO, optimization criterion

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