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Optimization Analysis of Controlled Cooling Process for H-Shape Steam Beams

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Abstract : In order to improve the comprehensive mechanical properties of the steel, the cooling rate, and the temperature distribution must be controlled in the cooling process. A three-dimensional numerical model for the prediction of the heat transfer coefficient distribution of H-beam in the controlled cooling process was performed in order to obtain the uniform temperature distribution and minimize the maximum stress and the maximum deformation after the controlled cooling. An algorithm developed with a simplified conjugated-gradient method was used as an optimizer to optimize the heat transfer coefficient distribution. The numerical results showed that, for the case of air cooling 5 seconds followed by water cooling 6 seconds with uniform the heat transfer coefficient, the cooling rate is 15.5 (℃/s), the maximum temperature difference is 85℃, the maximum the stress is 125 MPa, and the maximum deformation is 1.280 mm. After optimize the heat transfer coefficient distribution in control cooling process with the same cooling time, the cooling rate is increased to 20.5 (℃/s), the maximum temperature difference is decreased to 52℃, the maximum stress is decreased to 82MPa and the maximum deformation is decreased to 1.167mm.

Keywords : controlled cooling, H-Beam, optimization, thermal stress
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