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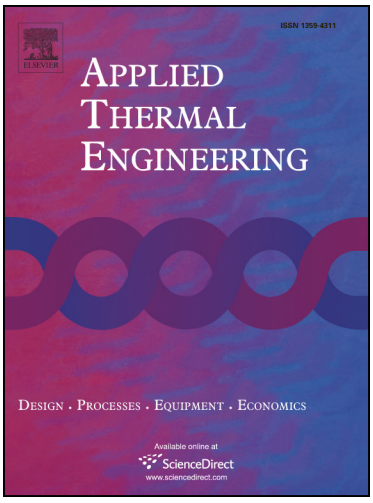

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Experimental and numerical investigation of temperature effects on steel members due to solar radiation

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Abstract: Sharp and non-uniform temperature changes of steel members due to solar radiation may cause potential security problems in large-span spatial steel structures. To determine the rules governing thermal stress and deformation of steel members under solar radiation and to obtain the relationship between temperature and thermal stress, experiments were designed and conducted with common steel members including rectangular steel tube, steel I-beam, and circular steel tube, under different constraints. Using the test data, the solar-induced temperature effects on each, especially bending stress, are analyzed in detail. Moreover, a numerical method to simulate the effect of temperature changes on steel members is evaluated against measured results to assess its validity. The experimental study demonstrates that the effect of temperature on steel members is significant and cannot be overlooked and that the numerical simulation presented in this paper is effective. The test procedure and research conclusions provide significant resources for thermal design, monitoring, and control of large-span spatial steel structures.

Keywords: Experimental study; thermal stress; bending stress; thermal deformation; solar radiation; steel members.

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