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Fatigue performance of stainless steel bolts in tension under variable amplitude loading

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ABSTRACT

This study experimentally investigates the variable amplitude fatigue performance of A4–70 stainless steel bolts under axial tensile loading. Static tests were first performed to establish the load-axial elongation relationship. Constant amplitude and variable amplitude fatigue tests were subsequently conducted to obtain the fatigue loading cycles and failure modes. The fracture surfaces were inspected via macroscopic and microscopic morphology analyses. The fatigue performance was eventually evaluated in terms of S–N data, and the equivalent fatigue strength of the bolts under variable amplitude loading was calculated based on their cumulative damages. The predictions of several international design codes for bolt fatigue were compared with the test results to verify the feasibility of these provisions. The results of the study showed that the bolt fracture surfaces possess significant morphology features representing the respective fatigue damage progresses. The fatigue performance of the stainless steel bolts under variable amplitude loading is influenced by the loading sequence and load amplitude. Current design codes can provide conservative predictions of the fatigue life of A4–70 stainless steel bolts in tension.

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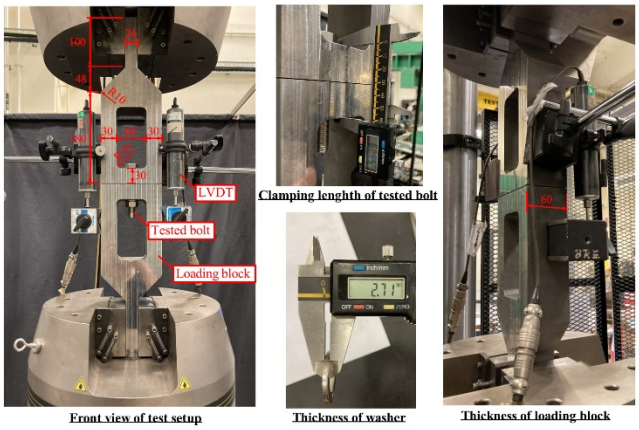

Fig. 1 Test setup of tensile loading (Unit: mm)