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Numerical studies on shear resistance of headed stud connectors in different concretes under Arctic low temperature

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Abstract:

Steel-Concrete-Steel (SCS) sandwich composite plate or shell structure has emerged as a viable solution for the Arctic offshore structure. Headed stud connectors are the essential structural components to enforce the composite action in the steel-concrete interface in these structures. This paper presents a parametric investigation on the shear resistance and failure mechanism in the shear connectors under low temperatures representing the Arctic conditions. The finite element (FE) approach used in the parametric study considers both material and geometric nonlinearities. Validation of the finite element procedure utilizes 54 previously reported experimental tests, with the objective to confirm the accuracy of the FE approach in predicting both the failure mechanism and the ultimate shear resistance of the stud connectors. The numerical study performs subsequently a comprehensive parametric investigation on 96 stud connectors, with the mechanical properties of the steel and concrete material measured at low ambient temperatures. To facilitate the engineering design of these connectors at low temperature conditions, this paper integrates the enhancement factors of the steel and concrete materials in a shear resistance estimation recommended in Eurocode 4.

Keywords: Stud connector; Steel-Concrete-Steel sandwich structure; Arctic offshore structure; steel-concrete composite; Finite element analysis; shear resistance; low temperature; material properties.

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