

Study on the Contact Mechanics Characteristics of the Interface between Sand and Foundation Structure

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Abstract : The constitutive model of the contact surface is usually established by conducting interfacial shear tests in a fixed-size shear box. Given that these models are derived from experimental data, their reliability is generally unquestioned and, therefore, widely adopted, while the effect of size effects on the results of contact shear tests is often ignored. In this paper, ABAQUS software is used to numerically simulate the main mechanical characteristics of the contact surface between sand and concrete structures under unidirectional shear load. By changing the size of the shear vessel, including its length, height, and ratio of length to height, the influence of size effect on the mechanical characteristics of the contact surface of sand and concrete structures is analyzed from three aspects: shear dislocation zone, shear deformation, and strength characteristics. It is found that there is an obvious shear dislocation phenomenon on the contact surface; that is, the sand deformation is obviously divided into three regions: the upper part is the boundary influence zone, the middle part is the sand deformation zone, and the lower part is the shear dislocation zone, the thickness of which is 30mm. When the contact surface reaches the shear strength, the corresponding dislocation displacement is about 1mm. The length of the contact surface affects the shear stiffness and shear strength, and the height mainly affects the shear strength. The shear deformation characteristics of the contact surface have an obvious size effect, but the shear strength characteristics have no size effect. When the length and height of the sand are equal, the overall constraint of the sand is the weakest, the shear of the sand is the most thorough, and the shear displacement is about 5 times that of the length-height ratio of 2. This study has proved that the contact surface between sand and structure is not a common contact surface but a special shear dislocation zone with a certain thickness and shear deformation properties different from sand and structure, which has universal research value and applicability.

Keywords : contact surface, mechanical properties, shear test, shear zone

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