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Hydro-mechanical coupling analysis method for dynamic response of coral reef island airport foundation under aircraft load

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Airports on South Pacific islands are often built on coral sand foundations. The coral sand particles of the foundations are characterized by high porosity, irregular shapes, and particle fragile. The hydro-mechanical coupling responses of the coral sand foundation caused by the cyclic aircraft load are still unknown. This research focuses on the increase in porous pressure and softening of the sand structure of the foundation, which are the dominant factors affecting the long-term stability of the airport foundation. To obtain those factors, a hydro-mechanical coupling simulation was conducted with a typical foundation FEM model composed of the runway, foundation, and base rock. The Biot dynamic consolidation theory and the viscoelastic plastic constitutive model of the coral sand were applied in the simulation. The aircraft moving load was calculated via the International Flatness Index (IRI) method. The response characteristics of the coral island airport foundation under the long-term aircraft moving loads were simulated, and the evolution of foundation damage and long-term settlement during airport operation were obtained. The long-term stability evaluation of typical coral island airport foundations was obtained through the deformation control theory.

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Primary author: ZHANG, Ning (Nanjing Tech University)

Co-author: Prof. ZHAO, Kai (Nanjing Tech University)

Presenter: ZHANG, Ning (Nanjing Tech University)

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