

عنوان مقاله:

A COUPLED FVM-DEM NUMERICAL MODEL FOR SIMULATION OF WATER WAVE INDUCED PORE PRESSURE
IN POROUS SEABED

محل انتشار:

سیزدهمین همایش بین المللی سواحل، بنادر و سازه های دریایی (سال: 1397)

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خلاصه مقاله:

The interaction between water waves and porous seabed is one of the most attractive subjects in the field of coastal engineering. The evaluation of the wave-induced response of a porous seabed is a key factor in the study of sediment transport, because sea beds may be liquefied under the cyclic pressures induced by the incoming waves which provides potential nearshore sediment transport. In the last few decades, numerous models for the wave induced seabed response have been developed with various assumptions. The examples for these models include [1]: uncoupled models, consolidation models, $u-p$ approximation, dynamic models and poro-elastoplastic models. However, The seabed properties change by wave loadings, which in turn affect the wave propagation, a mechanism which has not been considered in the aforementioned models. The coupled FVM-DEM method has been successfully studied for modeling water seepage flow [2]. In this study a coupled FVM-DEM model is introduced which simulates the wave-porous medium interaction and includes the solution for the fluid and solid parts simultaneously. 2. Methodology A two-dimensional coupled finite volume method (FVM) and discrete element method (DEM) model has been developed to simulate the pore water pressure buildup in the wave-induced seabed. The fluid motion was formulated by Navier-Stokes equations with the consideration of porosity and fluid-particle interaction terms [3]. The solution of the fluid flow is based on a 2DV model, (WISE; Width Integrated Stratified Environments) developed by Hejazi et al [4]. WISE uses finite volume method to discretize Reynolds-averaged Navier-Stokes equation on a structured non-orthogonal curvilinear staggered mesh. The model was further developed to include the wave-porous medium interaction using extended continuity and Navier-Stokes equations. The motion of the individual particles was numerically simulated using the DEM with the inclusion of the interaction with the fluid. DEM provided a solution of particle-particle collision problem by integration of Newton's second law equation based on a second order finite difference approach.

کلمات کلیدی:

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