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Development of Wave-Dissipating Block Installation Simulation for Inexperienced Worker Training

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Abstract : In recent years, with the advancement of digital technology, the movement to introduce so-called ICT (Information and Communication Technology), such as computer technology and network technology, to civil engineering construction sites and construction sites is accelerating. As part of this movement, attempts are being made in various situations to reproduce actual sites inside computers and use them for designing and construction planning, as well as for training inexperienced engineers. The installation of wave-dissipating blocks on coasts, etc., is a type of work that has been carried out by skilled workers based on their years of experience and is one of the tasks that is difficult for inexperienced workers to carry out on site. Wave-dissipating blocks are structures that are designed to protect coasts, beaches, and so on from erosion by reducing the energy of ocean waves. Wave-dissipating blocks usually weigh more than 1 t and are installed by being suspended by a crane, so it would be time-consuming and costly for inexperienced workers to train on-site. In this paper, therefore, a block installation simulator is developed based on Unity 3D, a game development engine. The simulator computes porosity. Porosity is defined as the ratio of the total volume of the wave breaker blocks inside the structure to the final shape of the ideal structure. Using the evaluation of porosity, the simulator can determine how well the user is able to install the blocks. The voxelization technique is used to calculate the porosity of the structure, simplifying the calculations. Other techniques, such as raycasting and box overlapping, are employed for accurate simulation. In the near future, the simulator will install an automatic block installation algorithm based on combinatorial optimization solutions and compare the user-demonstrated block installation and the appropriate installation solved by the algorithm.

Keywords : 3D simulator, porosity, user interface, voxelization, wave-dissipating blocks
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