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ANALYSIS OF RUN-UP AND OVERTOPPING IN COASTAL PROTECTION STRUCTURES: VIDEO-MONITORING TECHNIQUES

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Abstract

Marginal protection structures or adherent longitudinal defenses, whose main function is to mitigate overtopping, are structures parallel to the coast. They are intended to serve as protection and shelter against flooding, due to overtopping, dissipating wave energy in their interaction with the structure, and in areas strongly affected by coastal erosion, minimizing the risk of damage to roads, walkways or buildings in the proximity.

The evaluation of run-up and overtopping in marginal protection structures is determined according to the conditions of incident sea agitation and the characteristics of the structure, being fundamental for the design of new structures and in the verification of the safety of existing structures.

To characterize the response of a typical stretch of adhering defense to the incident sea waves, a set of tests were carried out in the LNEC's irregular wave channel in a 2D reduced model of this stretch.

The aim of this work is to evaluate and improve the applicability of damage evaluation methods, through the eroded volume, and run-up video monitoring techniques, using timestack images.

This work describes the experimental installation, including the various instruments used to measure the time series of the various quantities of interest and the test program, presenting the measured quantities in a subset of the tests considered the most interesting. These magnitudes include the elevation of the free surface associated with the incident agitation, the runup along the slope, the volume of water passing the structure and the armour layer damage.

Several techniques for characterizing these phenomena are used:

- **Run-up:** by using a video-monitoring technique. Wave run-up is obtained using timestack images and compared to data from a wave gauge placed over the structure cross-section;
- **Overtopping:** the equipment used to collect the overtopping water consisted of a tank, located at the back of the structure. The water was directed to the tank by means of a chute, 40 cm wide. A graduated reservoir is installed outside the tank where the water volume is measured. Also, a wave gauge is installed in the tank to measure both the individual and total water volumes.
- **Non-intrusive methodologies for the assessment of armour layer damage evolution:** in addition to the visual identification of rocking and displaced armour units, a Kinect© motion sensor, installed over the structure, is used. The acquisition of depth values by the Kinect© is determined by the Time of Flight method, where the distance between the points of a surface and the sensor is measured by the time of flight of the light signal reflected by the surface.

Results obtained through the different techniques are analysed and compared, namely: $Ru_{2\%}$, eroded volume, damage values and individual and mean overtopping volumes.