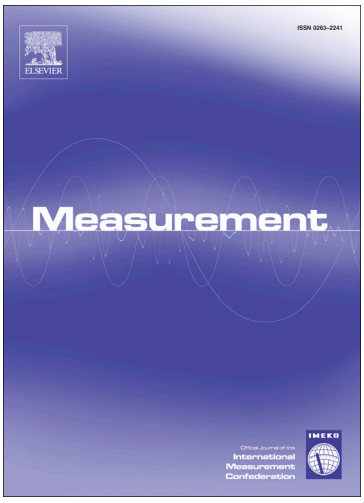

3-D Monitoring of Rubble Mound Breakwater Damages

Rosaria E. Musumeci, Davide Moltisanti, Enrico Foti, Sebastiano Battiato, Giovanni M. Farinella

PII: S0263-2241(17)30791-1
DOI: https://doi.org/10.1016/j.measurement.2017.12.020
Reference: MEASUR 5151

To appear in: *Measurement*

Received Date: 31 July 2017
Revised Date: 12 December 2017
Accepted Date: 13 December 2017

Please cite this article as: R.E. Musumeci, D. Moltisanti, E. Foti, S. Battiato, G.M. Farinella, 3-D Monitoring of Rubble Mound Breakwater Damages, *Measurement* (2017), doi: https://doi.org/10.1016/j.measurement.2017.12.020

3-D Monitoring of Rubble Mound Breakwater Damages

Rosaria E. Musumeci[a,*], Davide Moltisanti[b], Enrico Foti[a], Sebastiano Battiato[b], Giovanni M. Farinella[b]

[a] *Department of Civil Engineering and Architecture, University of Catania, Viale Andrea Doria 6, Catania, Italy*
[b] *Image Processing Laboratory, University of Catania, Viale Andrea Doria 6, Catania, Italy*

Abstract

Breakwaters play a crucial role in the protection of coastal zones. Their maintenance is critical to safeguard the daily activities of harbours and marine areas. The evaluation of damage is a necessity for timely preservation works. Traditional monitoring methods span various techniques, ranging from mechanical profilers to optical systems. Current methods though are typically expensive, requiring remarkably sophisticated technologies which demand a high degree of expertise to be operated.

In this paper, we propose an affordable yet accurate fully automated method based on 3D cameras. Our technique is non invasive, allowing hence non intrusive as well as fast measure of damage over time, simultaneously above and below sea water level. Experimental results obtained on laboratory breakwater models demonstrated that the proposed point cloud method, which does not depend on the imaging sensor and can be applied to any 3D dataset of rubble mound breakwater, can achieve accurate damage estimation, even when using a budget RGB-D camera. One of the additional advantages of using RGB-D cameras is the possibility to obtain measurements also in the presence of water.

Keywords: RGB-D cameras, Optical measurements, Accropodes, Underwater Measurements

1. Introduction and Motivation

Breakwater structures are used worldwide to protect harbours and coastal zones from wave attack. Depending on the local availability of materials, on the bathymetric conditions, on the wave climate and on specific design requirements, breakwaters can be built by using rocks or concrete units, located as a double or

*Corresponding author
Email addresses: rmusume@dica.unict.it (Rosaria E. Musumeci), davidemoltisanti@gmail.com (Davide Moltisanti), efoti@dica.unict.it (Enrico Foti), battiato@dmi.unict.it (Sebastiano Battiato), gfarinella@dmi.unict.it (Giovanni M. Farinella)