

Built environment

CSIR develops high-accuracy wave measurement system

A newly developed system enables the CSIR to assure port authorities and advise coastal engineers on the safe and efficient design of ports. Researchers at the hydraulics laboratory of the CSIR in Stellenbosch, together with video image processing specialists, have developed the new 'keofloat' system to measure very small waves in the laboratory. This invention gives the CSIR an edge over other laboratories in the world, especially for wave agitation and ship motion studies for large ports.

The innovative keofloat system is a physical model that has earned the CSIR's Dr Wim van der Molen accolades from his peers. His speciality fields - moored ship modelling and manoeuvring modelling - are invaluable in enabling decision makers to plan and implement harbour infrastructure and operations effectively.

In the final design stage of a new port or port expansion, physical modelling is used to check the weakening of waves in the port due to waves from the sea. Because of the sheer size of modern ports, these models are usually constructed at a small scale of 1:100. Together with tight criteria on limited wave heights, especially for the loading and unloading of container ships, the waves in the port basin in the laboratory are thus very small, in the order of a few millimetres. These small waves need to be measured.

Keofloats are cylindrical polystyrene blocks that are agitated by waves produced by a wave generator in the laboratory, and monitored by a video camera. A sophisticated computer algorithm is used to determine the vertical position of the keofloat at sub-pixel accuracy. The estimated accuracy is 0,3 mm or better for waves smaller than 1 cm, whereas conventional probes, which rely on the conductivity or resistance of water, guarantee 0,5 mm to 1 mm accuracy.

Van der Molen explains, "We are able to accurately determine the size of small waves in a specific harbour layout, taking into account the physical wave phenomena of diffraction around breakwaters, refraction (curving of wave propagation) around shipping channels and in shallow areas, and wave reflection against revetments and quay walls."

The CSIR has deployed keofloats in a project for a marina in the Seychelles and a port in the Persian Gulf.



Keofloats allow researchers to determine small wave sizes accurately in a specific harbour layout



Dr Wim van der Molen in the hydraulics laboratory at the CSIR's Stellenbosch site

- Hilda van Rooyen

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