Measurements of Cloaking Produced by an Array of Circular Cylinders

In the field of water waves, there has been recent interest in a process known as cloaking. According to this concept, the waves scattered by a fixed body are manipulated in the region immediately surrounding the object to eliminate scattering at large distances from the body. Cloaking of a bottom-mounted vertical monopile was first proposed by Porter (2011), who manipulated the bathymetry in the surrounding region to minimise the scattered energy to values approaching zero. Newman (2013) investigated cloaking of a surface-piercing cylinder of finite draft by introducing an array of bodies or an axisymmetric structure around the central object. In this case, a multivariate optimiser was successfully coupled with the boundary-integral equation software WAMIT to identify geometric arrangements resulting in minimal far-field wave scattering at a specified wavelength. The existence of arrays of bodies capable of cloaking has more recently been confirmed numerically by Kashiwagi et al. (2015) using the theory of Kagemoto and Yue (1986) in conjunction with a higher-order, boundary-element method. Kashiwagi et al have furthermore presented experimental results supporting the numerical findings for array-type cloaking. From a practical perspective, the elimination of the meandrift force on a surface-piercing structure associated with the cloaking process may find application in the reduction of second-order mooring loads in large offshore structures. This paper describes a further experimental investigation into the cloaking of a circular cylinder of finite draft using a circumferential array of eight surrounding cylinders. The aims of the work were:

- to identify a cloaking geometry suitable for investigation in the facilities available at DTU
- to design and build an apparatus to investigate wave scattering by this and other geometries,
- to confirm cloaking at one wavelength by measuring the mean drift force and far-field scattering.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Massachusetts Institute of Technology
Contributors: Read, R., Bingham, H. B., Newman, J. N.
Number of pages: 4
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 31th International Workshop on Water Waves and Floating Bodies (IWWFB 2016)
Electronic versions:
read_iwwfb_31.pdf
URLs:
http://www.iwwfb.org/Workshops/31.htm
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016