PRIMaRE - Partnership for Research in Marine Renewable Energy PRIMaRE Summer School

2018-09-11

Summer School - Tuesday 11 September 2018 - Experimental planning I: Facilities and set-up

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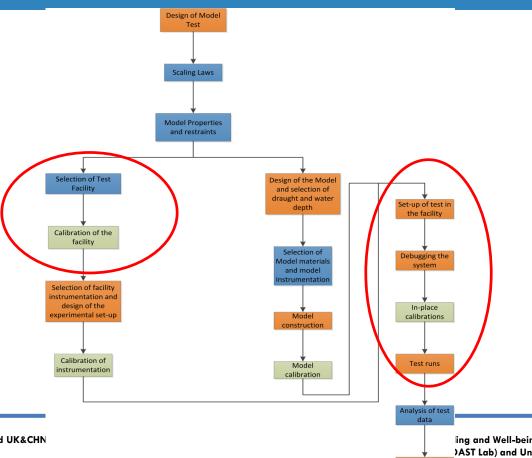
Experimental planning I: Facilities & set-up

Dr Carlos Perez-Collazo 11th Sep 2018



Experimental planning





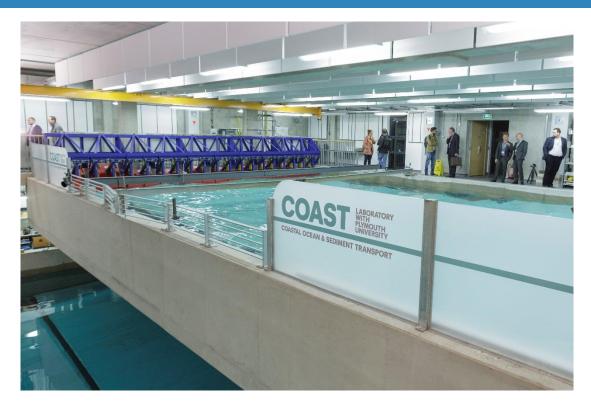
Joint PRIMaRE and UK&CHN Summer School 10-14th of September 2018 ing and Well-being in Engineering
AST Lab) and University of Exeter
(Penryn Campus)

Documentation



Facilities







Facilities



- Wave generation and absorption
- Basin and flume flow
- Towing tanks
- Blockage effects



Wave generation



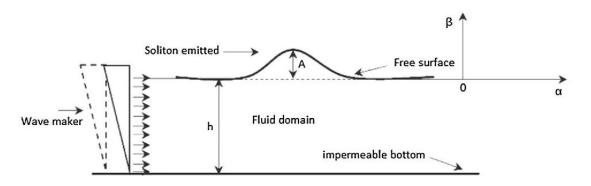
- Wave makers
 - Deep water generation
 - Shallow water generation





Piston wavemaker Oukechn core

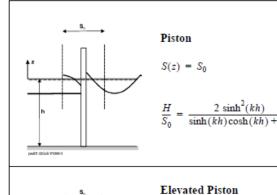










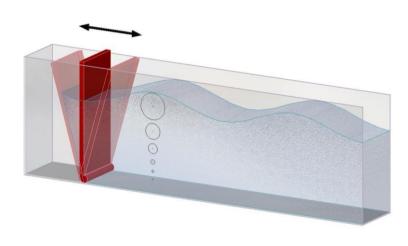


$$\frac{H}{S_0} = \frac{2[\sinh(kh) - 2\sinh(kh_0)\sinh(kh)]}{\sinh(kh)\cosh(kh) + kh}$$

Image from: DHI. DHI wave synthesizer. User guides: DHI; 2005.



Flap wavemaker

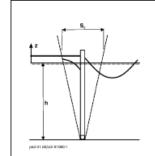






Flap wavemaker

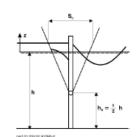
Table 4.1 Biésel transfer functions for four common types of wavemakers



Hinged

$$S(z) = \frac{S_0}{h} (h + z)$$

$$\frac{H}{S_0} = \frac{2 \sinh^2(kh)(1 - \cosh(kh) + kh \sinh(kh))}{kh(\sinh(kh)\cosh(kh) + kh)}$$



Elevated Hinged

$$\begin{bmatrix} S(z) = S_0 & \frac{h+z-h_0}{h-h_0} & ; & (z+h) & > & h_{0o} \\ S(z) = 0 & ; & (z+h) & < & h_0 \end{bmatrix}$$

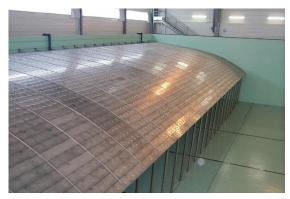
$$\frac{H}{S_0} = \frac{2 \left[\sinh\left(kh\right) \left((h-h_0)k \sinh\left(kh\right) - \cosh\left(hk\right) + \cosh\left(kh_0\right) \right) \right]}{k(h-h_0) \left[\sinh(kh) \cosh(kh) + kh \right]}$$

Image from: DHI. DHI wave synthesizer. User guides: DHI; 2005.



Wave absorption









Images from: http://www4.edesign.co.uk



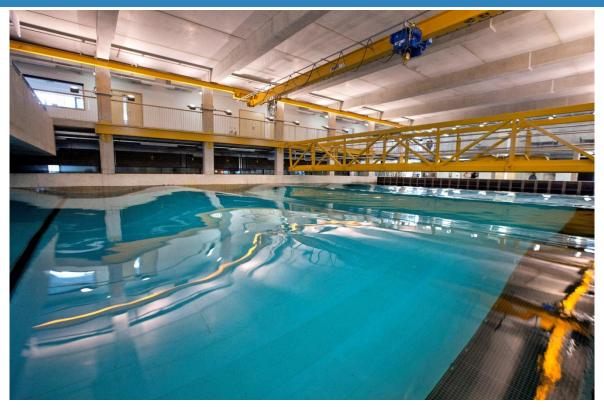
Coastal Basin





Ocean Basin







Flumes





Towing tank

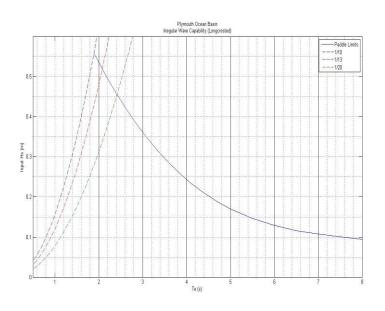




Limitations





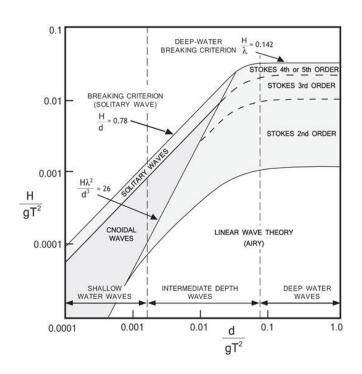




Limitations









Blockage effect



Waves

Model width to tank width > 5:1

Currents

Cross-section of the model to cross-section of the channel < 10%.



Standard tests - wave



Test series	TRL Level	Facility	2D-3D	Test duration	
Series A: Linear regular waves	1-4	flume-basin	2D	50-100 waves (300 if resonance)	
Series B: Non-linear regular waves	3-5	flume-basin	2D		
Series C: Long-crested irregular waves	1-5	flume-basin	2D	1 h full scale or (> 700 waves)	
Series D: Spectral shape	2-5	flume-basin	2D-3D		
Series E: Directional long-crested waves	2-5	Basin	3D		
Series F: Short-crested waves	2-5	Basin	3D		
Series G: Combined waves and ocean currents	2-5	flume-basin	2D-3D	test specific	
Series R: Repeatability	1-5	flume-basin	2D-3D		



Survivability tests - wave Oukechn core



Test series	TRL Level	Facility	2D-3D	Test duration	
Series H: Long-crested	2-5	flume-basin	2D-3D		
Series I: Long-crested and directional	3-5	flume-basin	2D-3D		
Series J: Short-crested	3-5	basin	3D	3 hrs (full scale)	
Series K: Combined wave and ocean current	3-5	basin	3D	,	
Series R: Repeatability	2-5	flume-basin	2D-3D		



