2018-09-11

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

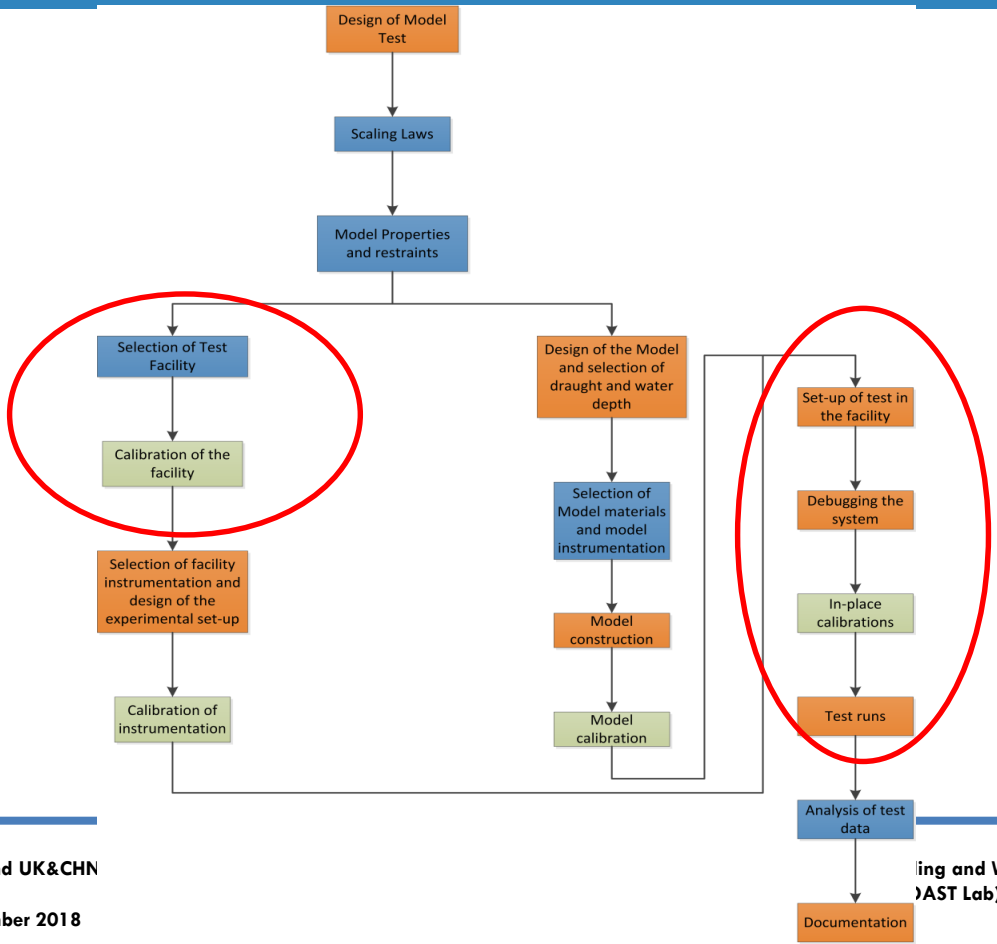
Perez-Collazo, C

Experimental planning I: Facilities & set-up

Dr Carlos Perez-Collazo

11th Sep 2018

Experimental planning



Facilities


COAST
LABORATORY WITH PLYMOUTH UNIVERSITY
COASTAL OCEAN & SEDIMENT TRANSPORT

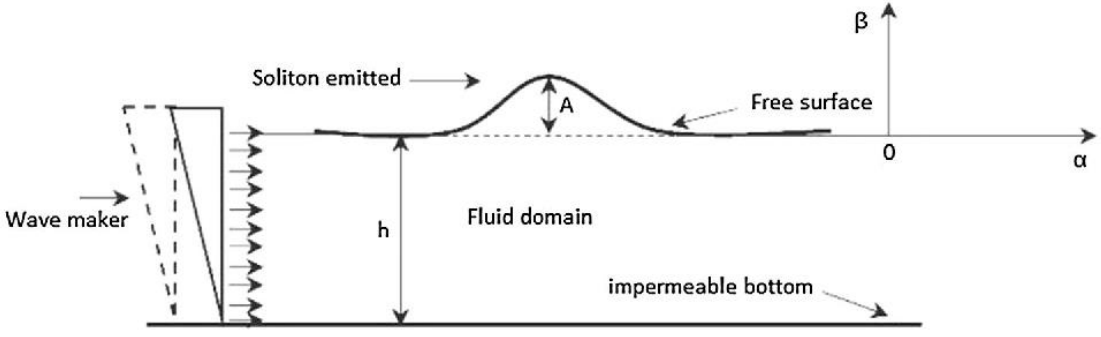
Facilities

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

Wave generation

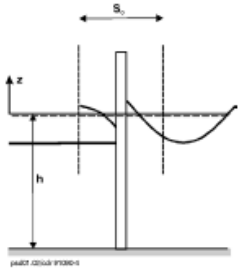
- Wave makers
  - Deep water generation
  - Shallow water generation

Piston wavemaker



Piston wavemaker

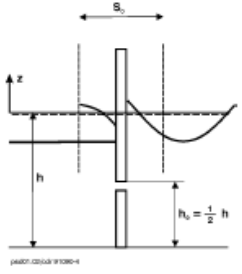
Table 4.1 Biésel transfer functions for four common types of wavemakers



Piston

$$S(z) = S_0$$

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



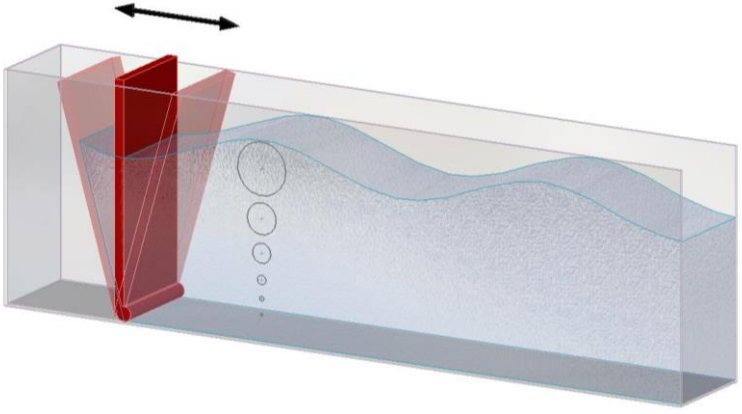
Elevated Piston

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

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

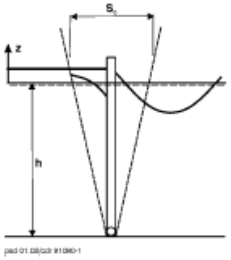
Image from: DHI. DHI wave synthesizer. User guides: DHI; 2005.

Flap wavemaker



Flap wavemaker

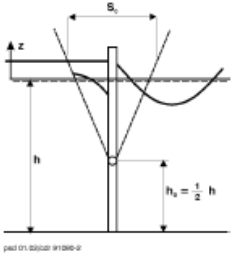
Table 4.1 Biésel transfer functions for four common types of wavemakers



Hinged

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

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



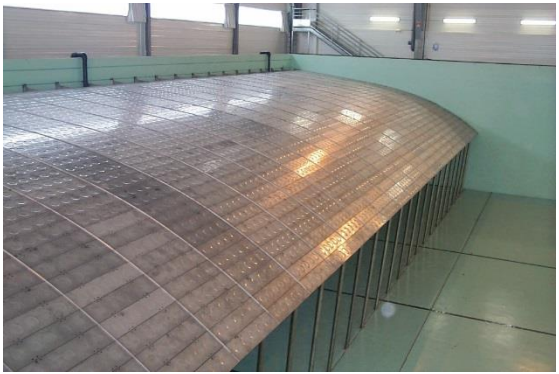
Elevated Hinged

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

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

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

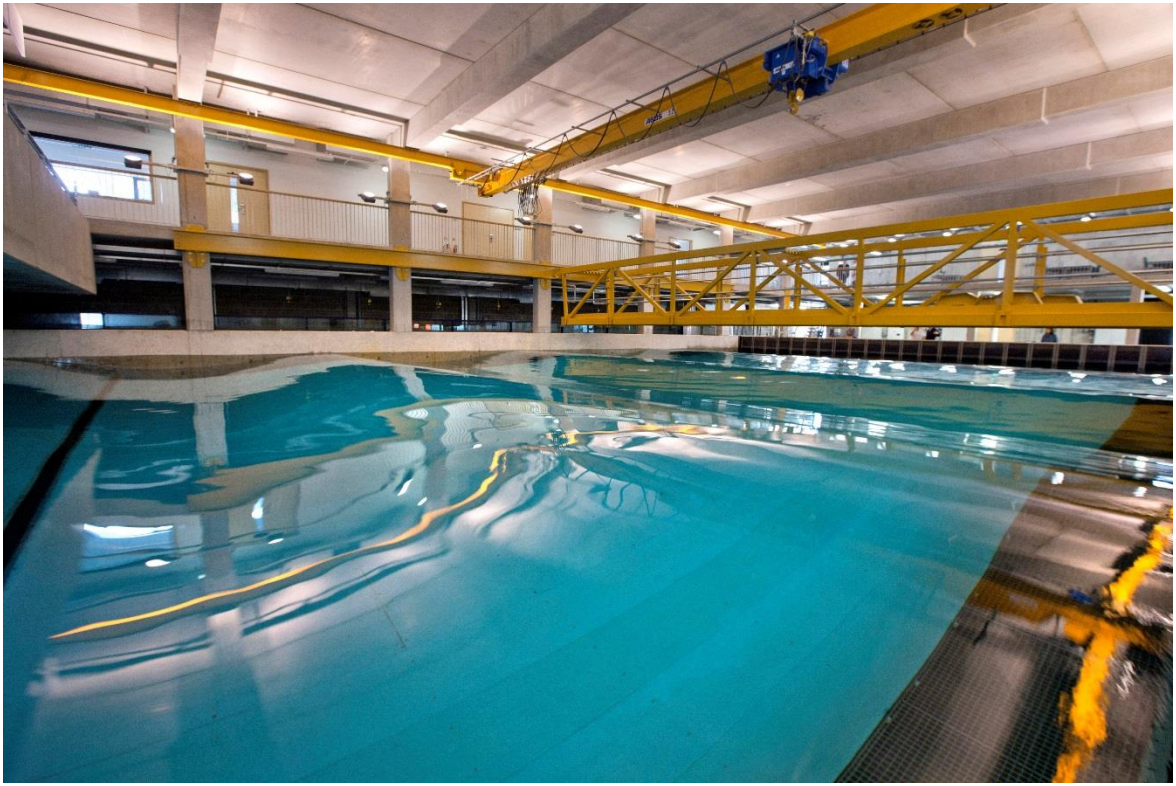
Wave absorption



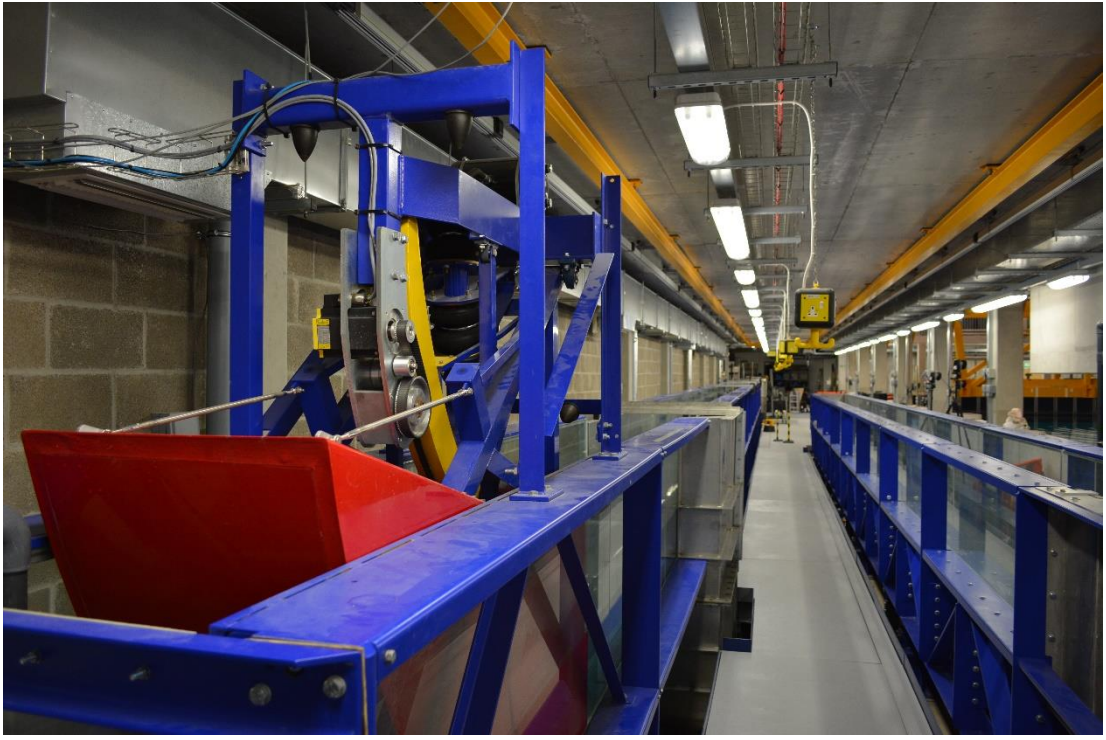
Images from: http://www4.edesign.co.uk

Coastal Basin

Ocean Basin

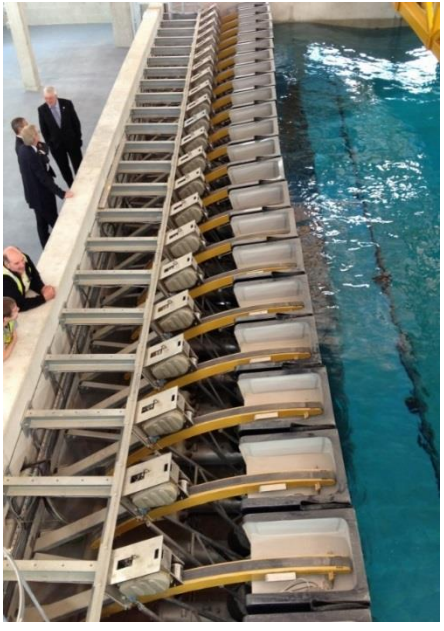


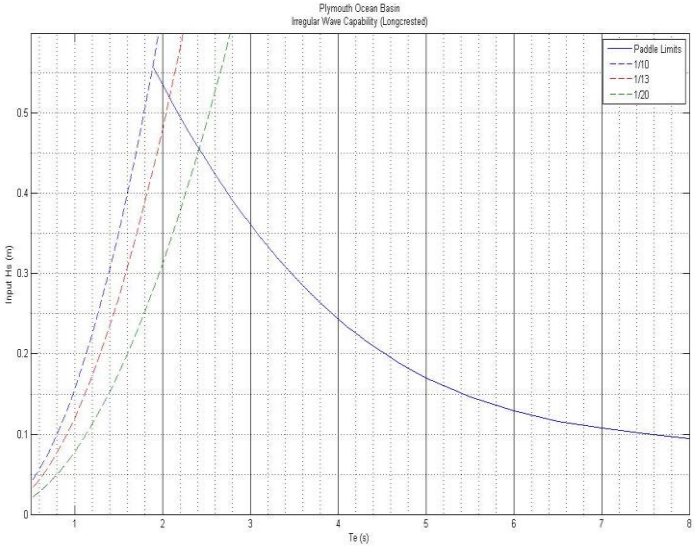
Flumes



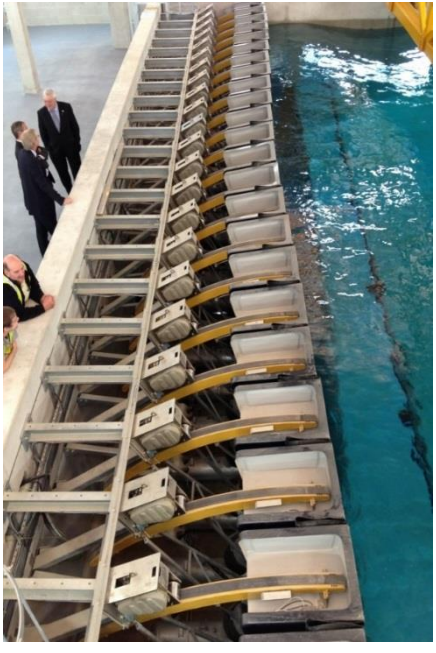
Towing tank

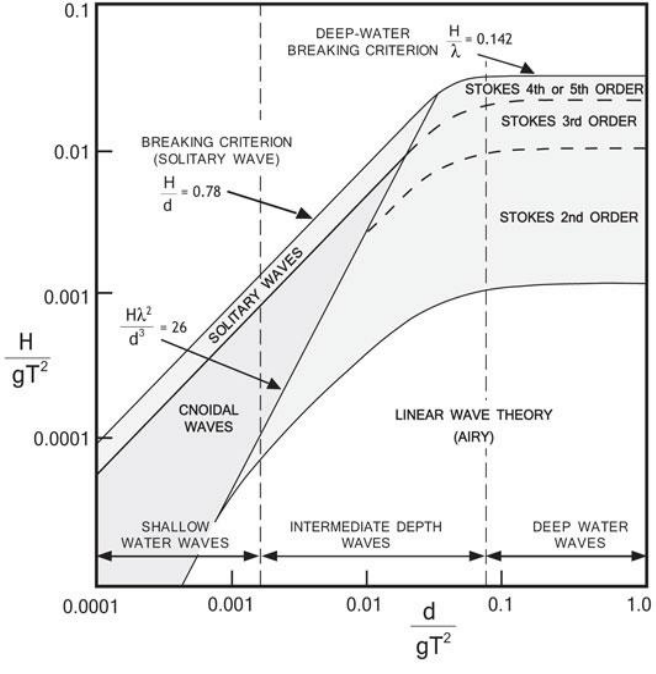
Limitations





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

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