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SPATIAL DISTRIBUTION OF WAVE PRESSURES ON SEAWAVE SLOT-CONE GENERATOR

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INTRODUCTION This paper presents results on loading acting on an innovative caisson breakwater for electricity production. The work reported here is part of the European Union Sixth Framework programme priority 6.1 (Sustainable Energy System), contract 019831, titled “Full-scale demonstration of robust and high-efficiency wave energy converter” (WAVESSG). Information on wave loadings acting on Wave Energy Convert (WEC) Seawave Slot-Cone Generator (SSG) exposed to extreme wave conditions are reported. The SSG concept is based on the principle of overtopping and storing the wave energy in several reservoirs placed one above the other. Using this method practically all waves, regardless of size and speed are captured for energy production. In the present SSG setup three reservoirs have been used (Fig.1).

Figure 1 – Artist impression of the Wave Energy Convert (WEC) Seawave Slot-Cone Generator (SSG)

LABORATORY STUDY Model tests have been performed in a wave tank at Aalborg University, in 1:60 length scale compared to the SSG prototype at the planned location of a pilot plant at the west coast of the island Kvitsøy near Stavanger, Norway. This wave basin (commonly called the deep 3-D wave basin) is a steel bar reinforced concrete tank with the dimensions 15.7 x 8.5 x 1.5 m. The paddle system is a snake-front piston type with a total of ten actuators, enabling generation of short-crested waves. Fourteen Kulite Semiconductor pressure cells were used to measure the pressure in a total of 25 positions on the structure plates. Two different transducer configurations were needed because of the very limited space inside the model combined with the physical dimensions of the pressure transducers (Fig. 2).

RESULTS Mainly two different behaviours were identified: surging waves on the front sloping plates and damped impact water jet on the vertical rear wall in upper reservoir. Spatial distribution of wave pressures on the front plates were discussed. In fig. 3 the non dimensional pressure is plotted, where smi represents the inshore wave steepness, h is the waters depth in front of the structure and z is the transducer elevation from the swl. The pressure on the front plates were comparable with the one predicted by Takahashi and Hosoyamada (1994), even if a modified version of T&H formula show a better response in terms of spatial pressure distribution. On the vertical rear wall in the upper reservoir impact pressures (very peaked, short duration) were registered. Also for this wall a new formula was set up following the main concept shown in Takahashi et al. (1991) for a caisson with vertical slit front face and open wave chamber. The results of these studies are intended to be of direct use for design and stability of the pilot plant under construction at Kvitsøy island (Norway).

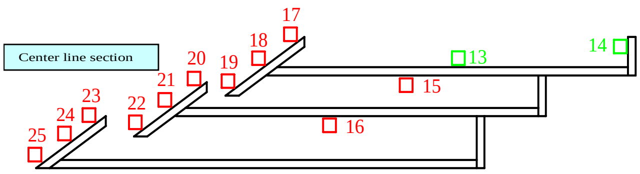

Figure 2 – Second test configuration and pressure cells locations.

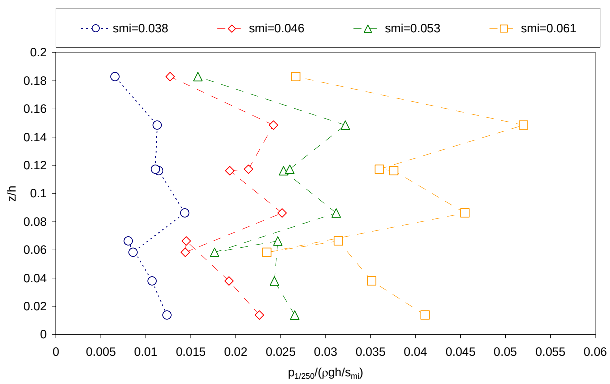

Figure 3 – Non dimensional spatial distribution of wave pressures on the front plates under different wave conditions.

REFERENCES

Kofoed, J. P. (2006), "Experimental Hydraulic Optimization the Wave Energy Converter Seawave Slot-Cone Generator", Hydraulics and Coastal Engineering No. 26, ISSN: 1603-9874, Dept. of Civil Eng., Aalborg University.

Takahashi, S., Shimosako, K., and Sasaki, H. 1991. "Experimental Study on Wave Forces Acting on Perforated Wall Caisson Breakwaters," Report of Port and Harbour Research Institute, Yokosuka, Japan, Vol 30, No. 4, pp 3-34 (in Japanese).

Takahashi, S., and Hosoyamada, S. (1994), "Hydrodynamic Characteristics of Sloping Top Caissions," Proceedings of International Conference on Hydro-Technical Engineering for Port and Harbour Construction, Port and Harbour Research Institute, Japan, Vol 1, pp 733-746.

Vicinanza, D., Kofoed, J. P. and Frigaard P. (2006), " Wave loadings on Seawave Slot-cone Generator (SSG) at Kvitsøy island (Stavanger, Norway)", Hydraulics and Coastal Engineering No. 35, ISSN: 1603-9874, Dep. of Civil Eng., Aalborg University.

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