Numerical and Experimental Investigation of Two Porous Wave-breaking Structures

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- Background
- Experimental configuration
- Numerical configuration
- Results
- Conclusion

Background

Floating breakwater: low price and flexible deployment

“Breakwaters reduce the intensity of wave action in inshore waters and thereby reduce coastal erosion or provide safe harbourage.”

-- wikipedia

The cost of traditional vertial and oblique breakwater increases greatly with the increase of water depth, and the construction difficulty is also increased significantly.

98% wave energy is concentrated in the range of water depth about three times of the wave height, counting below the free surface level .

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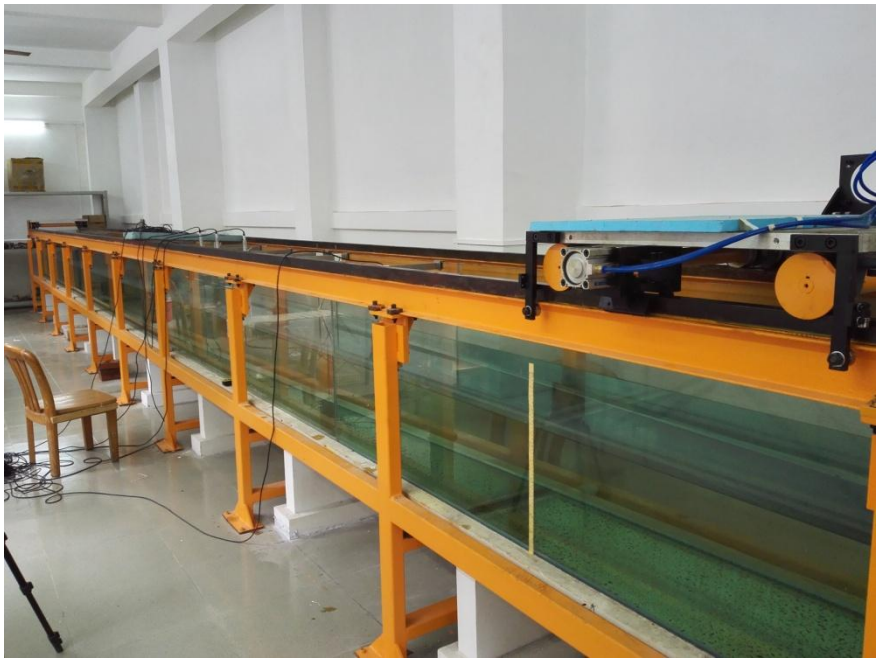
Experimental configuration (1)



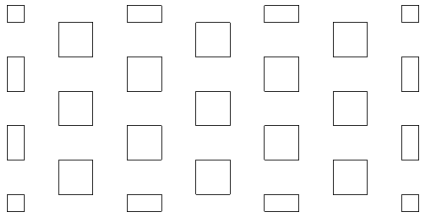
The experimental flume in Department of Applied Mechanics and Engineering , Sun Yat-sen University

Installed porous model

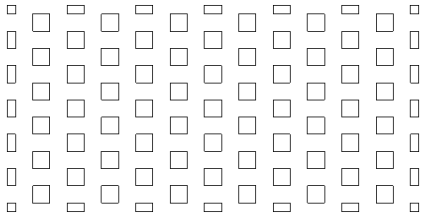
Length: 15 m
Width: 0.6 m
Water depth: 0.37 m
Paddle-type wavemaker

Experimental configuration (2)

Photo of model 1 & 2



model 1



model 2

Model cross-sections

Length: 0.6 m, Width: 0.24 m, Height: 0.12 m, Porosity: 0.5

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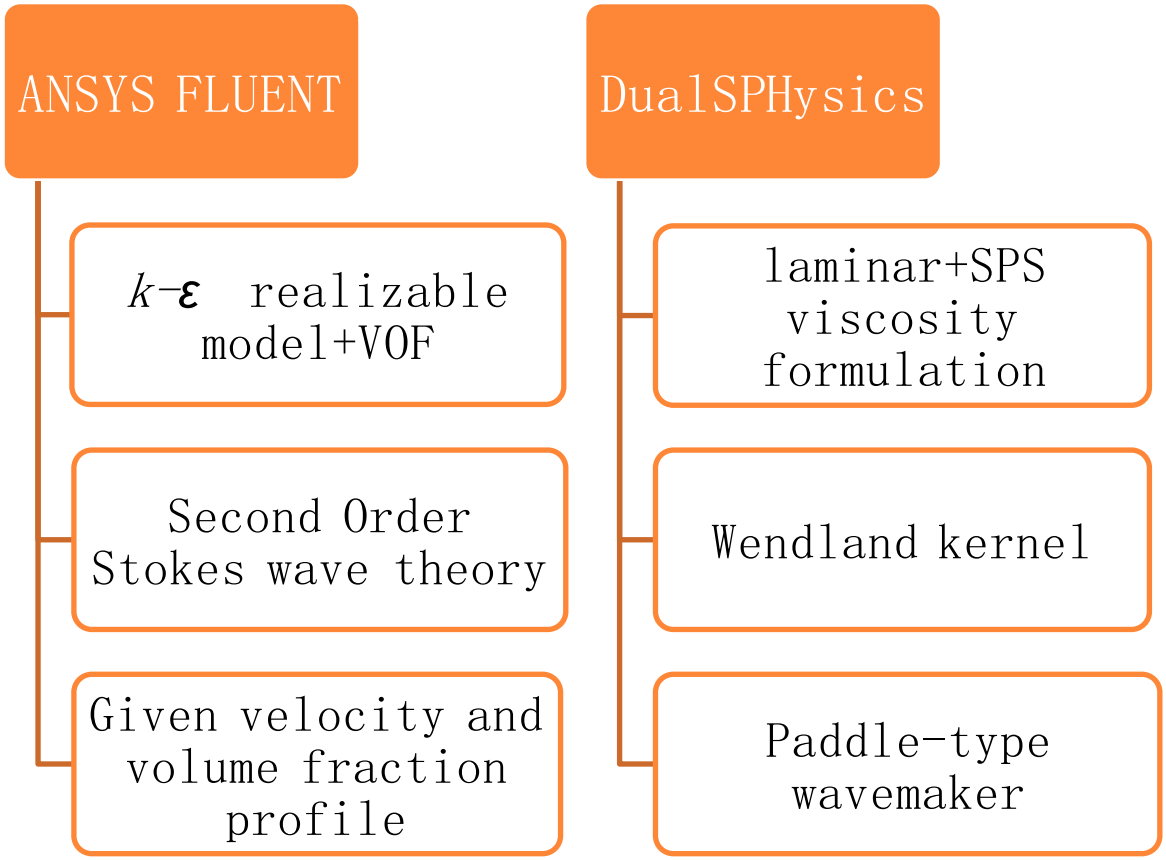
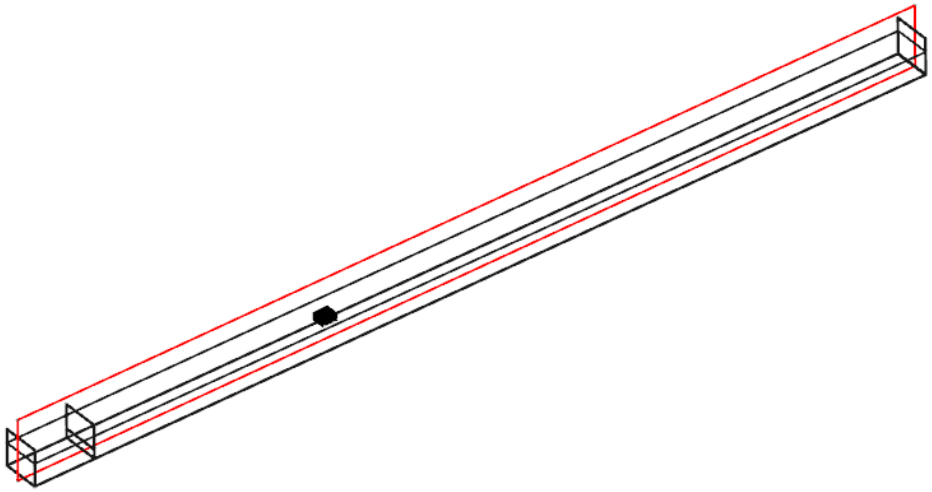
Numerical configuration



Numerical configuration

- wave height: 0.04 m
- wave period: 1 s

- 2D calculation
- Same size of the experiment
- A smaller calculation area is used to valid the dp independency



DualSPHysics calculation geometry configuration

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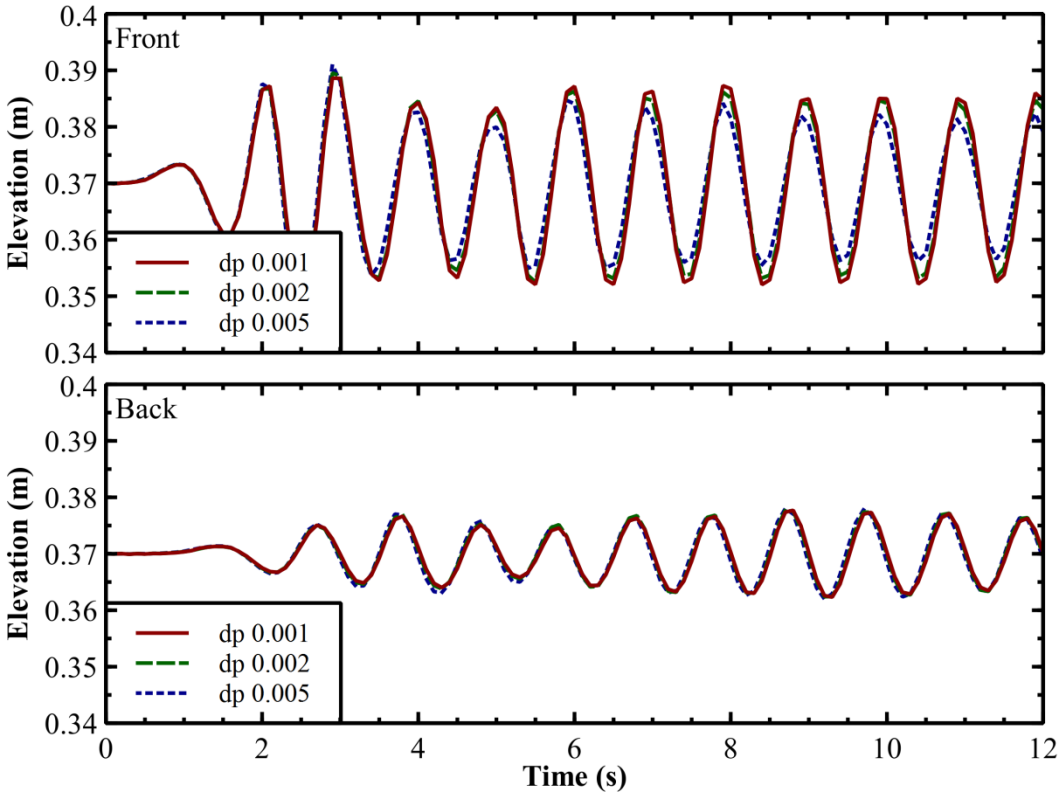
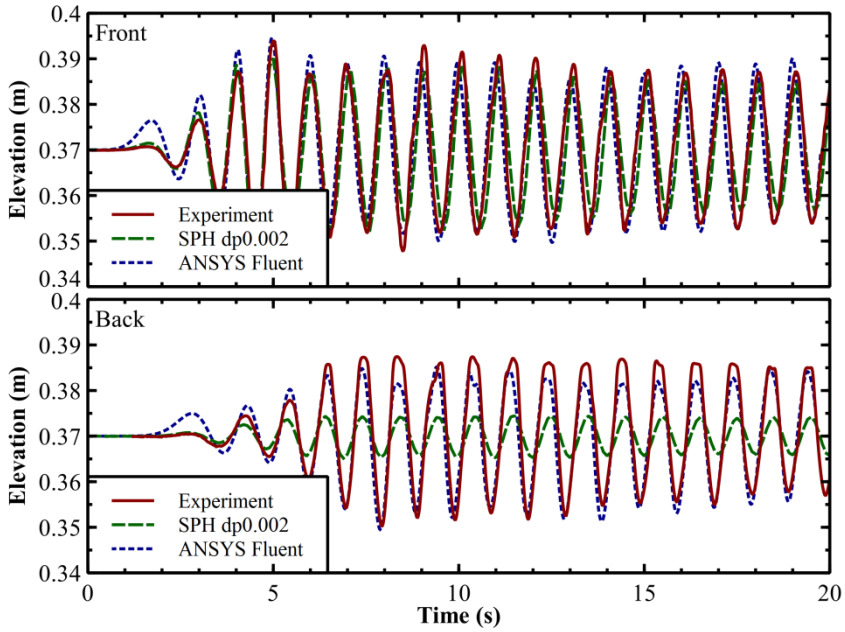
Results (1)—dp independency

dp 0.002 m is chosen

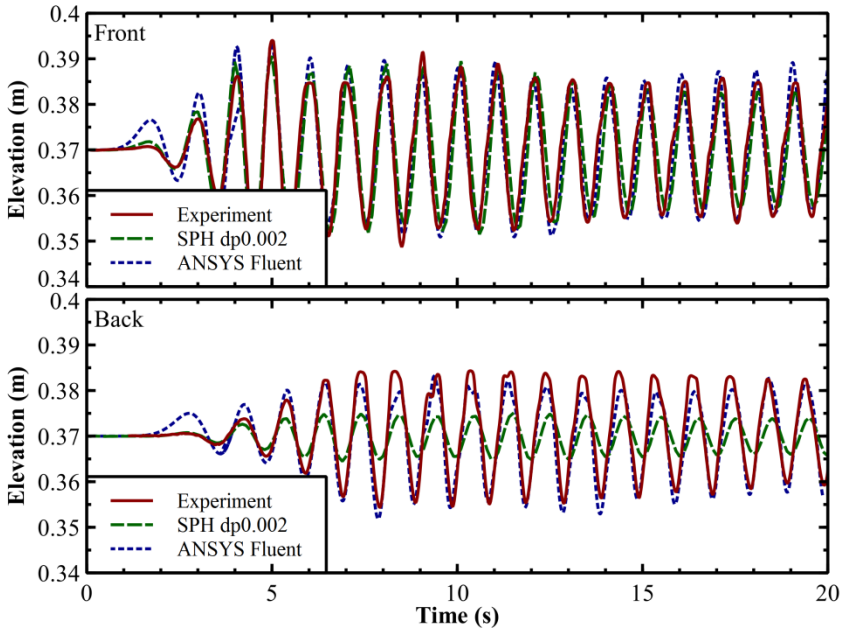


Water elevation before and after model with different inter-particle distance (dp)

Results (2)--comparison

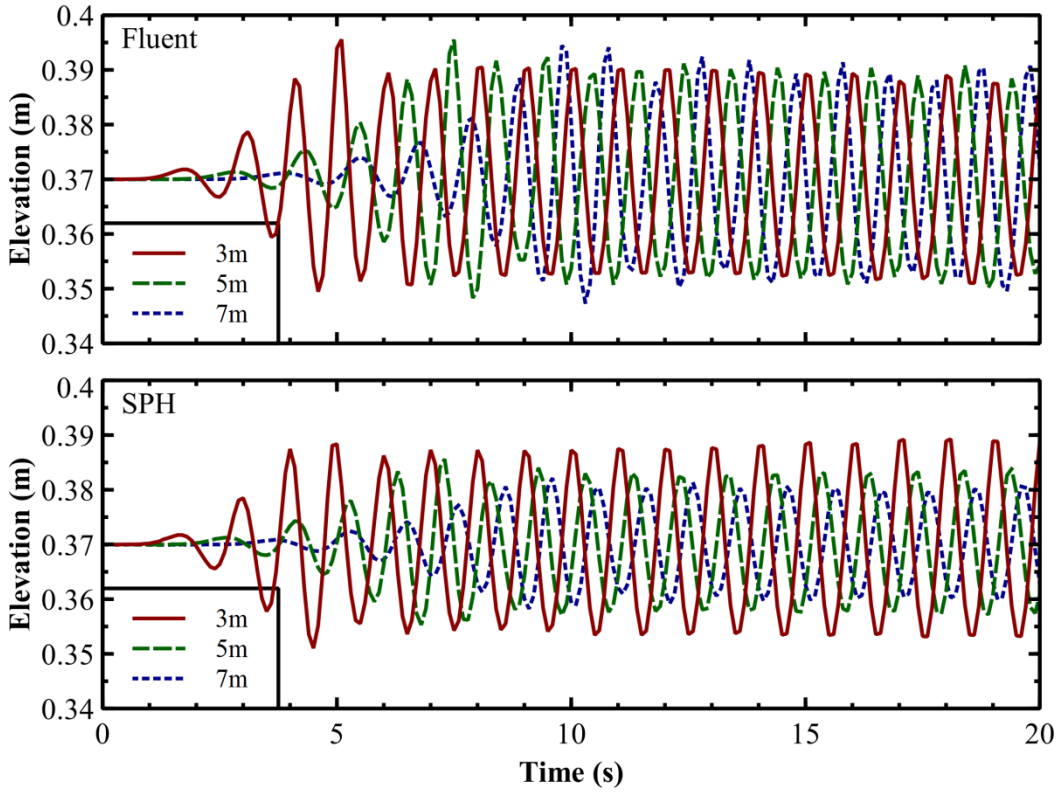


Model 1



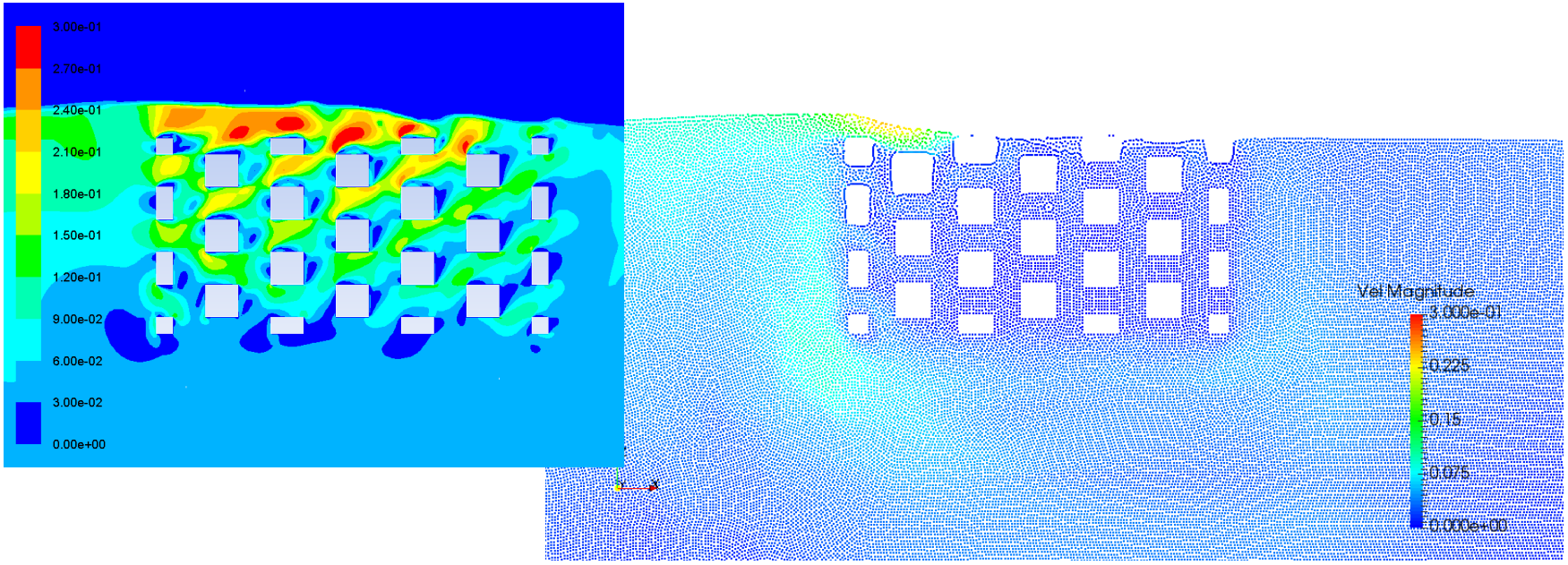
Model 2

Results (3)



Water elevations at different locations (without model)

Results (4)



Velocity field near the model

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Conclusion

- With DesignSPHysics, it is very convenient to set up the calculation
- Due to the method used for making wave, DualSPHysics performs well at the onset of wave
- Wave attenuation during propagation is found in DualSPHysics calculation
- The large difference between experimental and SPH results may caused by the calculation settings

Thanks for your attention !