DISCUSSIONS

39th International Workshop on Water Waves and Floating Bodies

April 14-17, 2024
St Andrews, Scotland

This booklet is a collection of the Discussion Sheets from the 39th International Workshop on Water Waves and Floating Bodies (IWWWFB), held in St Andrews, Scotland, April 14-17, 2024. The Discussion Sheets include the questions raised after each presentation, along with the authors' responses. The number of Discussion Sheets varies for each paper. The Discussion Sheets are sorted in the same order as the extended abstracts in the workshop Proceedings.

For information about IWWWFB 2024, please see the Proceedings and the Workshop website: https://sites.dundee.ac.uk/iwwwfb2024/

With best wishes,
Masoud Hayatdavoodi

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies

St Andrews, Scotland, 14-17 April 2024

Paper title: Interaction of flexural gravity waves with an ice sheet having variable geometry in the presence of current

Author(s): Aggarwal, A., Barman, K.K., Martha, S.C., Tsai, C.-C.

Questioner: A. Korobkin

Question(s) / Comment(s):

Could you please give a reference and /or some explanations about Eq. (2) of the elastic plate, which is not flat?

Authors' Responses (use the back of the page if needed):

Dear sir,

Please refer to equations (2.5) and (2.6) in "Porter, D., & Porter, R. (2004). Approximations to wave scattering by an ice sheet of variable thickness over undulating bed topography. Journal of Fluid Mechanics, 509, 145 179 " with D(x,y) as constant ice sheet thickness `d'(as in our work) and variation d(x,y) as P(x). Following that, the modifications we considered in equation (2.6) (in the presence of current). Further, combining equations (2.5) and (2.6) will lead to the equation relevant to the equation (2) in our work. Removing the current, and putting D(x,y) = d, d(x,y)=P(x) will result in the same equation. Please refer to " Aggarwal, A. et al. (2024). Water wave interaction with ice sheet of variable geometry in the presence of uniform current. Physics of Fluids, 36(4) 4)" for more details.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: The harmonic separation of measured force components on a model jacket from waves and current - phase and symmetry based analysis

Author(s): Archer, A.J., Wolgamot, H., Orszaghova, J., Taylor, P.H., Dai, S.

Questioner: H. Bredmose

Question(s) / Comment(s):

Very nice analysis! I am intrigued about the second-order subharmonic base, that changes sign with the current. Can you explain the mechanism behind this?

Authors' Responses (use the back of the page if needed):

Thanks for your question, Henrik.

The basic structure of the dependency of current on the second-harmonic difference (2-) drag forces can be explained by our derived drag harmonic expression,

$$(\cdots)a^3\left[1+3(ka)^{-2}\frac{u_{cs}}{c}\right]$$

The blue term outside the square brackets is the wave-only force, which comes from the effect of the varying free surface, hence it scales with the wave amplitude cubed. The yellow u_cs is the blocked current. This indicates that the wave-only (2-) force is positive, and faster negative currents give negative (2-) forces.

This drag harmonic expression is obviously a simplification of the actual loading behaviour. Only linear wave kinematics are considered, so any stokes drift / return flow effects are not considered. Since the IWWWFB, we have validated the accuracy of our drag harmonic expressions by comparing to exact drag forces from Stokes' 5th wave theory. It shows that, although the wave-only force is poorly approximated (which is to be expected), the amplification from current (inside the square brackets) well approximates the force amplification.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: High-order surface integration methods for an unstructured triangulation of the ship geometry

Author(s): Bingham, H.B., Amini-Afshar, M.

Questioner: Moritz Hartmann

Question(s) / Comment(s):

Regarding the operator D_jk (Eq.7), would it be possible to use also a Lagrange basis polynomial interpolation operator?

Authors' Responses (use the back of the page if needed):

Thanks for that suggestion. Lagrange interpolation is one of several ways to find the unique polynomial interpolant of degree n, using a structured grid of n x n points. In my case, I am working with a scattered point-set which in general does not have a well-defined set of interpolation points with a unique polynomial interpolant. That is why I have adopted the WLS method.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies

St Andrews, Scotland, 14-17 April 2024

Paper title: High-order surface integration methods for an unstructured triangulation of the ship geometry

Author(s): Bingham, H.B., Amini-Afshar, M.,

Questioner: A. Korobkin

Question(s) / Comment(s):

For the rectangular barge in your slides, there are no derivatives of the potential at the corner points. How do you proceed with your algorithm in this case?

Authors' Responses (use the back of the page if needed):

Actually, we have rounded the sharp corners of the barge here, so we avoid any singularities.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: High-order surface integration methods for an unstructured triangulation of the ship geometry

Author(s): Bingham, H.B., Amini-Afshar, M.

Questioner: Binbin Zhao

Question(s) / Comment(s):

The cases shown here are using simple-shape. Does OceanWave3D-seakeeping predict ship motions wave added resistance of oil tankers, container ship and so on? Thank you!

Authors' Responses (use the back of the page if needed):

I've only shown simple geometries here, but the code can easily handle real ship geometries. You can read many examples in the references listed on the web page for the open-source package.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Large time response of a floating viscoelastic plate in the vicinity of saddle point

Author(s): Boral, S., Ni, B.-Y, Korobkin, A.A.

Questioner: Mike Meylan

Question(s) / Comment(s):

How did you force this problem. Why is growth $t^{2/3}$? I would expect t^2 for three roots. Is this the effect of the group velocity?

Authors' Responses (use the back of the page if needed):

Thanks for your comments. The forcing is from the external periodic load. I have evaluated the growth like t^{α}, s.t. $\alpha < 1$. Akylas(1984) demonstrated the growth near the resonance like $t^{\frac{1}{2}}$ for free surface flows. Yes, the growth is $t^{\frac{2}{3}}$ for frequencies near the saddle point, where both the group velocity and its derivative with respect the wavenumber vanish.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: A force model for non-slender bodies in fully nonlinear waves

Author(s): Bredmose, H., Mignacco, M., Pegalajar-Jurado, A.

Questioner: John Grue

Question(s) / Comment(s):

I would expect viscous effects to contribute to the experimental QTFs for the geometry in consideration, since this has several thin members, and flow separation will be important.

Authors' Responses (use the back of the page if needed):

Thanks.

We will combine the inviscid forces here with viscous forces from the Morison equation with relative velocity $(u-\dot{x})|u-\dot{x}|$ integrated on the structure. Our experience with this is that we need to include calibrated additional damping which is sea state dependent. Some examples of this are given in Borg et al Marine structures 2024 vol 94; Hamen et al JFM 2024 vol 982 and Orszaghova IWWWFB 2023.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies

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Paper title: A force model for non-slender bodies in fully nonlinear waves

Author(s): Bredmose, H., Mignacco, M., Pegalajar-Jurado, A.

Questioner: Peter Wellens

Question(s) / Comment(s):

Should the incident wave signal be filtered? And how would filtering affect the force results?

Authors' Responses (use the back of the page if needed):

Thanks!

The idea is to avoid filtering. All harmonics, linear and bound, are treated in the same way, taking their special structure into account based on the k-space decomposition.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Applicability of the Morrison equation for calculating loads on a vertical cylinder due to breaking and near-breaking waves

Author(s): Buldakov, E.

Questioner: Jun Zang

Question(s) / Comment(s):

1. How rigid is your body? Base wave frequency of body natural frequency?
2. Have you mentioned the motion/response of your body?
3. I'm wondering if the response of the body may affect the peak value of the body?

Authors' Responses (use the back of the page if needed):

1. The body can be considered absolutely rigid. However, the support allows several oscillation modes. The main one is due to torsion of the support beam. The natural frequency for this mode is about 6.5Hz, measured in the filled tank. The peak frequency of the wave spectrum is about 0.7HZ.

2, 3 The response was not measured. However, SPH calculations with and without structural responses demonstrate negligible effect on the maximum force, as can be seen in Fig 16 of [1]. The main contribution of the responses are oscillations observed after the wave peak processes the body.

[1] Yong Yang, et al.

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Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies

St Andrews, Scotland, 14-17 April 2024

Paper title: Unsteady ship wave observed both on the ship and at sea

Author(s): Chen, X., Liang, H.

Questioner: Ayoub MANSAR

Question(s) / Comment(s):

I know it is not the purpose of this work, but have you investigated the breaking of these waves, or your waves break & if so, how is the breaking crest looking like?

Authors' Responses (use the back of the page if needed):

No I didn't.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Unsteady ship wave observed both on the ship and at sea

Author(s): Chen, X., Liang, H.

Questioner: Ayoub MANSAR

Question(s) / Comment(s):

You presented at fixed location the time-frequency spectrograms, did you try to analyse, in the fixed reference frame, the spatio-temporal data to extract the 3D dispersion plot (kx, ky, ω)?

Authors' Responses (use the back of the page if needed):

We have not yet analysed the time series at a series of fixed locations to extract the 3D dispersion plots. I agree that it should be very interesting to get them for unsteady ship waves generated by a real ship.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Prediction of motion responses for a semi-submersible FOWT platform using a greybox model integrated with a GRU-based deep learning approach

Author(s): Choi, D., Seo, J.Y., Ha, Y., Kim, K., Nam, B.W.

Questioner: H. Bredmose

Question(s) / Comment(s):

Can you comment how the neural network approach enhances the low-frequency responses, which is excited by nonlinear bring?

Authors' Responses (use the back of the page if needed):

Based on our observations, the deep learning technique based on neural networks primarily enhanced the wave-frequency responses, not the low-frequency response. Our interpretation is that the neural network model identifies the wave-frequency features more easily but struggles to identify the low-frequency features due to the longer natural periods. We believe that separate learning models are required for both wave-frequency and low-frequency responses, and regarding the low-frequency responses, much longer experimental data is needed.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Free surface pressure and profile measurements from seabed pressure gauges

Author(s): Clamond, D., Labarbe, J.

Questioner: Michael MEYLAN

Question(s) / Comment(s):

Could this work be extended to Acoustic gravity wave which are solutions of Helmholtz equation and arise from tsunamis.

Authors' Responses (use the back of the page if needed):

Yes.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Free surface pressure and profile measurements from seabed pressure gauges

Author(s): Clamond, D., Labarbe, J.

Questioner: John Grue

Question(s) / Comment(s):

Very nice results, particularly those involving vorticity. I suggest that these exact relations are of important value to interpret field measurement. Waves are usually long-crested, and the formulas are highly useful for field measurements.

Authors' Responses (use the back of the page if needed):

I agree.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Free surface pressure and profile measurements from seabed pressure gauges

Author(s): Clamond, D., Labarbe, J.

Questioner: Harry Bingham

Question(s) / Comment(s):

Given the exponential decay of the pressure under short waves, I would expect you would not be able to capture these which are shorter than about 2h or so. Is that correct?

Authors' Responses (use the back of the page if needed):

Indeed, the wave influence decays exponentially fast. For short waves in deep water, you need very high accuracy. You can also measure the pressure somewhere below the surface, not necessarily at the bottoms.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Faraday waves in a circular tank

Author(s): Colville, S.W., Scolan, Y.-M., Gambioli, F., Lee, Y.C., Greaves, D., Ransley, E.

Questioner: Simone Michele

Question(s) / Comment(s):

1) Experiments can be improved to find the maximum response. Figure 3 does not share that yet.

2) Extension to forcing spectra would be interesting to see if chaos occurs.

Authors' Responses (use the back of the page if needed):

1) Maximum response from mathieu equation would be interesting. Also to integrate cubic non linearity of a duffing-mathieu equation.

2) Would be interesting to investigate if chaos occurs experimentally in the non-linear response. We would have to consider different input signal.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Faraday waves in circular tank

Author(s): Colville, S.W., Scolan, Y.-M., Gambioli, F., Lee, Y.C., Greaves, D., Ransley, E.

Questioner: Eugeny Buldakov

Question(s) / Comment(s):

For faraday waves in a rectangular tank model evolution is described by Mathieau equation that has a complex system of resonances with continuous instability regions on the A-w space. Do you plan to perform a similar analysis for your tank configuration? (A, w - excitation amplitude and frequency)

Authors' Responses (use the back of the page if needed):

Yes would be a nice development of the work for this geometry, and of interest for upcoming non-isothermal testing.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Faraday waves in a circular tank

Author(s): Colville, S.W., Scolan, Y.-M., Gambioli, F., Lee, Y.C., Greaves, D., Ransley, E.

Questioner: Hui Liang

Question(s) / Comment(s):

1. Faraday wavs are governed by Mathieu equation

I wonder if you have looked into the stability diagram of the Mathieu equation.

2. Your research is motivated by cryogenic liquid sloshing in which phase change is notable. I wonder if the theory for room-temperature liquid sloshing still holds.

Authors' Responses (use the back of the page if needed):

1.The main steps to arrive at Mathieu equation is in the abstract (equation 5)

2.The fluid kinematics is the starting point as the sloshing reeynolds number has directly implications on thermodynamics. Future work looks to couple the fluid kinematic room temperature results with phase change/temperature stratification conditions.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Modelling attenuation of waves through broken ice of randomly-varying thickness

Author(s): Dafydd, L., Porter, R

Questioner: Dominic Reeve

Question(s) / Comment(s):

What justification do you have for the choice of a Gaussian correlation function? How sensitive are your results to this choice.

Authors' Responses (use the back of the page if needed):

Data shows that ice thickness is approximately Gaussian correlated. Additionally, the key features of the model remain when numerics are done without this assumption.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Modelling attenuation of waves through broken ice of randomly-varying thickness

Author(s): Dafydd, L., Porter, R

Questioner: Xinshu Zhang

Question(s) / Comment(s):

It seems you use linear free surface boundary condition in your model. What do you think about the effect of nonlinear free surface condition on the dissipation of the waves, in particular when sum-frequency or drift-frequency components are generated?

Authors' Responses (use the back of the page if needed):

Insufficient work has been done for me to accurately suggest non-linear effects. However, the non-linear terms appear at such an order under our sealing that I suggest their effects would be minimal under our assumptions.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies

St Andrews, Scotland, 14-17 April 2024

Paper title: Modelling attenuation of waves through broken ice of randomly-varying thickness

Author(s): Dafydd, L., Porter, R

Questioner: Malin Goteman

Question(s) / Comment(s):

In comparing your simple model to a realistic scenario - what would you say are the crudest approximations? The neglection of gaps, the heave motion, no physical interaction between ice sheet?

Authors' Responses (use the back of the page if needed):

Further analysis has shown our dispersion relations hold with narrow gaps inundation to block edge and a similar relation occurs when accounting for Coulomb friction. Further work is being done for pitch & roll. I'd suggest the 2D approximation for the highly heterogeneous ice is the crudest.

Discussion Sheet

The 39th International Workshop on
Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Three-dimensional directional focused by the HLIGN theory

Author(s): Duan, S.L.

Questioner: Yuxiang Ma

Question(s) / Comment(s):

1. How many vertical layers used?

2. The influence of water depth and the special energy change in difference wave spreading is suggested.

Authors' Responses (use the back of the page if needed):

Question1 ：

Answer: Only one layer is used in our simulation. We use the polynomial to fit the wave kinematic distribution along the water depth.

Comment2 ：

Many thanks for your comments！

Discussion Sheet

The 39th International Workshop on
Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Sea state influence on design waves for an M4 WEC

Author(s): Hansen, C.L., Wolgamot, H., Taylor, P.H., Kurniawan, A., Orszaghova, J., Bredmose, H.

Questioner: Eugeny Buldakov

Question(s) / Comment(s):

Is there a way of finding the design wave for a device without running multiple realizations of random sea states (numerically or experimentally)?

Authors' Responses (use the back of the page if needed):

Identification of the Design Wave requires information on both the response and the sea state which it occurs in.

In principle one can identify the Design Wave for any linear response by applying a wave to response transfer function and the wave spectrum for the sea state.

Since our work serves as a validation of our Design Wave method, the experiments were necessary to validate that the found Design Wave was able to reproduce the Design Response (average largest response in the given sea state). As we observed a good match between the Design Response (averaged from irregular waves) and the response to the Design Wave, we have shown that it is possible to construct a Design Wave signal if a wave to response transfer function is available.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Sea state influence on design waves for an M4 WEC

Author(s): Hansen, C.L., Wolgamot, H., Taylor, P.H., Kurniawan, A., Orszaghova, J., Bredmose, H.

Questioner: Harry Bingham

Question(s) / Comment(s):

Your design loading analysis is based on the free response (without) PTO. I wonder why this is necessary, given that those design sea states have very little energy near the resonance.

Authors' Responses (use the back of the page if needed):

The operational sea states are characterised by low steepness compared to the extreme sea states presented. It has been shown that sea states of equal steepness have equal spectral energy in the high-frequency tail of the spectrum (Phillips, JFM 1958). This means that the severe sea states have more energy at the resonance, even compared to operational sea states with peak period close to the natural period of the hinge. A check of the incident wave spectra showed that the severe sea state spectral energy is around ten times the operational at the hinge natural period.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Sea state influence on design waves for an M4 WEC

Author(s): Hansen, C.L., Wolgamot, H., Taylor, P.H., Kurniawan, A., Orszaghova, J., Bredmose, H.

Questioner: Guillaume Ducrozet

Question(s) / Comment(s):

1) You presented the reproduction of the design waves in experimental wave tank and observed some discrepancies. We developed recently with Bureau Veritas a design wave procedure that includes a nonlinear wave model to enhance the reproduction in experiments that you could refer to.

2) Did you compare in experiments the response to the design wave and the Monte/Carlo (long duration) corresponding response to the sea state considered to assess the accuracy of your design wave procedure?

Authors' Responses (use the back of the page if needed):

1) Thanks for sharing this with me. This is relevant work to reference in our paper which is currently under preparation.

2) We have performed a bootstrapping analysis, resampling the response crests many times and computing the average of the 30 largest response crests in each sample. This was done to compare three different random seeds of the same irregular sea state. We found a good match between the average of the bootstrap NewResponse crest heights and the NewResponse extracted directly from the data. Likewise for the amplitude of the NewWave crest height.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Internal solitary waves and floating bodies

Author(s): Hartharn-Evans, S., Carr, M., Stastna, M.

Questioner: H. Bredmose

Question(s) / Comment(s):

Thanks for a very interesting talk with good lab visulaizations. I wanted to comment that the solitary wave is a wave with infinite period and only positive velocities. In that view it makes sense that a small float simply follows the fluid velocities.

Authors' Responses (use the back of the page if needed):

I agree with the comment.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Internal solitary waves and floating bodies

Author(s): Hartharn-Evans, S., Carr, M., Stastna, M.

Questioner: John Grue

Question(s) / Comment(s):

What is the direct connection between the laboratory experiments and model simulations with the floats, and the observations in the Arctic, of the patterns of the sea ice?

Authors' Responses (use the back of the page if needed):

The ice patterns are thought to be a result of IW surface signature. In lab we have only looked at ISWS so the connection is not direct. However it does inform the first step in the process.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Experiments and computations of a floating cylinder

Author(s): Jensen, A., Coupez, T.

Questioner: A. Tassin

Question(s) / Comment(s):

Why did you select the case of a cylinder entering water and exiting water? Is it related to the capsizing of ice bergs?

Authors' Responses (use the back of the page if needed):

The original motivation was iceberg towing and then this in relevant. Now we try to validate the NS-model, with a very simple and controllable experiment.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Experiments and computations of a floating cylinder

Author(s): Jensen, A., Coupez, T

Questioner: Harry Bingham

Question(s) / Comment(s):

I wonder how long your iceberg-mounted sensors last?

Authors' Responses (use the back of the page if needed):

The sensors are with batteries and some with additional solar panel. The example showed sensors that was deployed during winter (Yermak plateau area) with less light. We were able to get two months of data from each sensor.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Experiments and computations of a floating cylinder

Author(s): Jensen, A., Coupez, T

Questioner: G. Ducrozet

Question(s) / Comment(s):

Did you try to model the water entry or the other configuration with a lower fidelity model to get a simpler approach to treat this problem?

Authors' Responses (use the back of the page if needed):

Yes, we tried OpenFoam as well. Works well, but with much more tuning. In the current model only the level set parameter is varied.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Some aspects of the three-dimensional hydroelastic slamming

Author(s): Khabakhpasheva, T., Korobkin, A.A., Seng, S., Malenica, S.

Questioner: Harry Bingham

Question(s) / Comment(s):

Concerning your stability problems in openFOAM, you may be interested in this recent paper:

Roerby, Aliyar & Bredmose 'A robust algorithm for computational floating body dynamics' Royal Society Open Science, 11(4), 231453.

Authors' Responses (use the back of the page if needed):

Thank you very much for this reference which we will carefully examine and contact the authors if necessary.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Can digital techniques be a supplementary or alternative tool for marine hydrodynamics?

Author(s): Kim, Y., Lee, J.-H., Ahn, Y., Wang, S.

Questioner: R.C. Ertekin, University of Hawaii & Harbin Engineering University

Question(s) / Comment(s):

In regard to your Fig.1, Digital method depends on one or more other methods, but other methods do not necessity depend on the digital method. Training for digital method must use one or more other methods, so it is not an independent method as implied in Fig. 1. Thank you!

Authors' Responses (use the back of the page if needed):

Thanks for this question! You are absolutely correct. We need to know other methods for

1) to get the training data if we don't have enough real data (mostly we don't)

2) to validate the solutions

3) to understand the physics involved.

Digital techniques cannot be the only method of solution.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
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Paper title: Turning circle maneuvers of the ONR tumblehome in bidirectional waves using a fast-running CFD approach

Author(s): Bradford Knight

Questioner: Kevin Maki

Question(s) / Comment(s):

What is training cost in terms of cpu-hrs relative to your estimate of the lost to simulate a single calm-water turn with discretised control services?

Authors' Responses (use the back of the page if needed):

The propeller and rudder model is trained with double-body CFD simulations with 9.7m cells, whereas, the maneuvers computations use grids of 1.0m cells or 2.8m cells, the maneuver in simulations have a low computation cost, but the training simulations are more expensive. (Knight & Maki 2022) showed that a data-driven propeller and rudder model breaks even with computational cost after just one calm water turning circle; however, the model used in this case uses a widely sampled parametric space, thus the cost to train the model is larger, since the intention of this propeller & rudder model is for generic maneuvers. Each training point is run 5.58s and there are a total of 42 samples are used to train the generalized propeller & rudder model, that can be applied to both zig-zag maneuvers and turning circle maneuvers in calm water and in waves.

The equivalent time in model scale would be (5.58 s/sample)(42 samples)=134 s. Thus, the total training cost is justified for just one turning circle maneuver in waves examined in this work.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Turning circle maneuvers of the ONR tumblehome in bidirectional waves using a fastrunning CFD approach

Author(s): B.G. Knight

Questioner: G. Ducrozet

Question(s) / Comment(s):

Your data driven model of the propeller/rudder system is based on CFD simulations without free surface effects. Since you study maneuvering in waves, is it a possible limitation of the result presented?

Authors' Responses (use the back of the page if needed):

The propeller and rudder model uses the analytical orbital wave velocity in the calculation of J and β. The details of the propeller and rudder models are detailed in *"Fast-running CFD calculations of the ONR Tumblehome performing maneuvers in calm water and in waves using a Gaussian process regression propeller and rudder model"*. Further analysis could be performed to investigate further effects of the interaction of waves on the propeller and rudder forces during a maneuver.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
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Paper title: Turning circle maneuvers of the ONR tumblehome in bidirectional waves using a fastrunning CFD approach

Author(s): Knight, B.G.

Questioner: Yonghwan Kim

Question(s) / Comment(s):

I assume that you applied constant RPS for propeller. However the ship has surge motion in waves, so RPS changes, either. Then I assume that you applied a constant RPS in calm water for the same forward speed. Could you confirm your approach to fix the RPS? Then it may be different with the initial condition or RPS in experiment. Any further comments?

Authors' Responses (use the back of the page if needed):

Yes, a constant propeller revolution rate of 8.8 rps was applied. This correlates to the self-propulsion point for a Froude number of 0.2 in calm water. This was the approach used for the SIMMAN, 2023 experiments, which were compared to for the long-crested wave case examined in this work.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies

St Andrews, Scotland, 14-17 April 2024

Paper title: Nonlinear wave diffraction by an uneven viscoelastic seafloor

Author(s): Kostikov, V.K., Hayatdavoodi, M., Ertekin, R.C.

Questioner: John Grue

Question(s) / Comment(s):

In the hazards of tectonic or slide-generated tsunami, the very large waves may in the shallower water split into a series of (several) solitary waves, due to nonlinear-disperse mechanism where such an example occurred in strait of Malacca, during the 2004 India Ocean tsunami. The period of the solitary waves was 20 sec. (crest to crest period).

The comment is an invitation to identify historical occurrences of solitary waves in the ocean, which you study.

Reference:

J. Grue, E. Oelinorsly, D. Fruetus, T. Talipora, c. Khanif.

Formation of undular bore and solitary waves in the strait of Malacca caused by the 2004 Indium Ocean tsunami.

Journal of Geophysical Research: Oceans, 113, 2008.

Authors' Responses (use the back of the page if needed):

Thank you very much for your comment! There is a map of the mud regions distribution in the world on the first slide of the presentation. For future studies and presentations, we shall map the regions where these violent wave phenomena occur. This will make the motivation of our research clearer.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Enhancement of Significant Wave Height Prediction through Aliasing Mitigation in Wave Radar Analysis

Author(s): Lee.J, Yang,H., Kim, Y.

Questioner: Jinyu Yao from Shanghai Jiao Tong University

Question(s) / Comment(s):

Thanks for your presentation. I have 2 questions:

1. When the waves are predicted by radar, there are some empirical parameters, such as β_{mean} in Eq.(1) in your abstract and β_{MTF} in MTF function. Have you done some sensitive test about these empirical parameters? Or how to choose suitable values of them for your test cases?

2. In the comparison of the results of Hs with and without aliasing, when Hs<4m, it seems that the results with aliasing are more accurate. Can you provide some comments on it?

Authors' Responses (use the back of the page if needed):

Thank you for your great questions.

1. We have done the sensitivity study to determine the β_{mean} and β_{MTF} based on the accuracy of significant wave height. Since the present study is based on the synthetic radar images, we can find the optimized value of empirical parameters that provide the best accuracy compared with the theoretical values. The optimized β_{mean} and β_{MTF} are 0.9 and 0.5, respectively.

2. The accurate estimation of significant wave height in Hs < 4m "without aliasing mitigation" is attributed to the compensation between overestimation and underestimation. We have solved the underestimation problem through the present study, but we have to further address the overestimation problems in Hs<4 in the future.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Enhancement of significant wave height prediction through aliasing mitigation in wave radar analysis

Author(s): Lee, J., Yang, H., Kim, Y.

Questioner: Xinshu Zhang

Question(s) / Comment(s):

When the height of radar is adjusted should the calibration i.e. with buoy data, be done for the radar?

Authors' Responses (use the back of the page if needed):

Thanks you for your question. My answer is yes. The empirical parameters used in radar analysis, such as β_{mean} and β_{MTF}, depend on the specifications (height, maximum raise) of the radar devices, so we have to do the calibration process for each radar device.

However, in our experience, the optimized values of the empirical parameters just vary slightly for the different specifications. Therefore, we can firstly use the empirical parameters recommended in literature.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: A least-square high-order boundary element method for modelling ship waves

Author(s): Liang, H., Liu, J., Taskar, B

Questioner: Harry Bingham

Question(s) / Comment(s):

Can you say a bit more about why you have chosen to use a least-squares approach rather than the usual collection approach leading to a square system.

Authors' Responses (use the back of the page if needed):

The conventional collocation approach imposes the boundary integral equation at model points. When we study a surface piercing body, it requires to impose the boundary integral equation on the waterline, which the determination of solid angle is a non-trivial task. Moreover, the normal vector at sharp edges/corners is discontinues.

To circumvent these difficulties, we impose the integral equation at the points within the patch, which yields an over-determined equation system.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: A least-square high-order boundary element method for modelling ship waves

Author(s): Liang, H., Liu, J., Taskar, B

Questioner: Yonghwan Kim

Question(s) / Comment(s):

When you set up the matrix for least square method, assume that you need to integrate the influence component of element. If so, why don't you consider to apply a Galerkin method which considers the boundary condition on the surface of element?

Authors' Responses (use the back of the page if needed):

Yes. I fully agree with you. After integrating the shape functions at the Gaussian points, it gives rise to the Galerkin BEM. However, I noted that the integration of shape function is time-consuming therefore, I keep the lower-determined equation system, which is solved via the least-square method.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Second order theory for interaction of flexible floating body with waves

Author(s): Malenica, S., Choi, Y.M., Kwon, S.H

Questioner: R.C. Ertekin, University of Hawaii & Harbin Engineering University

Question(s) / Comment(s):

Very elegant derivation, congratulations.

On your development, does it involve forward motion? If not, do you plan to include it in your future studies. Thank you.

Authors' Responses (use the back of the page if needed):

Many thanks for your question. Our current plan is to restrict ourselves to zero forward speed case. Extending the theory to the case with forward speed, along the same lines, could be possible in principle, however the situation is much more complicated. This is mainly because even the linear seakeeping problem with forward speed is still challenging due to the complex interactions of the steady and the unsteady flow components, which are not present in the zero forward speed case. That is why, going consistently beyond the linear formulation, for that case, is extremely challenging.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Floating flexible porous thin rectangular plates with free edge conditions exposed to incoming waves in three dimensions

Author(s): McGuire, K.H., Rinde Lund Jacobsen, H., Grue, J.

Questioner: A. Korobkin

Question(s) / Comment(s):

What is the pressure in your porous plate model? Is it with the hydrostatic component?

Authors' Responses (use the back of the page if needed):

Yes, although we have calculated that the hydrostatic pressure term does not contribute to the time-averaged porous work.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Floating flexible porous thin rectangular plates with free edge conditions exposed to incoming waves in three dimensions

Author(s): McGuire, K.H., Rinde Lund Jacobsen, H., Grue, J.

Questioner: Paul Taylor, NWA

Question(s) / Comment(s):

One difficulty with plates with free boundaries is the treatment of the structural edge conditions, these couple plate deformation into the plate and along the edge. For the special case of Poisson's ratio v=0, the edge conditions are simple. The authors might like to consider this special case.

Authors' Responses (use the back of the page if needed):

Thank you. We will test this.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Floating flexible porous thin rectangular plates with free edge conditions exposed to incoming waves in three dimensions

Author(s): McGuire, K.H., Rinde Lund Jacobsen, H., Grue, J.

Questioner: Sime Malenica

Question(s) / Comment(s):

How do you calculate the hydrostatic tensor for porous plate?

What is the ratio between the hydrostatic stiffness C compared to structural stiffness K?

Authors' Responses (use the back of the page if needed):

The hydrostatic tensor is defined as the inner product of the mode shapes, so porosity is not included directly in the hydrostatic tensor.

The values of K_{ijkl} range from zero to max(K_{ijkl}) where max(K_{ijkl}) depends on the number of modes used. But we can see how the relation $r=Max(C_{ijkl})/Max(K_{ijkl})$ changes in relation to the different test cases with the different values of π_1.

Specifically for the results shown at the conference with 64 modes, we have:

$r \sim 10^{-3}$, for $\pi_1=10^{-3}$

$r \sim 10^{-2}$, for $\pi_1=10^{-4}$

$r \sim 10^{-4}$, for $\pi_1=10^{-5}$

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Wave energy absorption by floating piezoelectric plates

Author(s): M. Meylan et al.

Questioner: E. Renzi

Question(s) / Comment(s):

How does piezoelectricity come into play in this model?

Authors' Responses (use the back of the page if needed):

In this work we use a model of piezoelectricity in the plate where for each frequency the stiffness has an imaginary part. The deviation of the form of this part was not included, but follows as in Renzi 2016.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Hydroelastic theory for offshore floating plates of variable flexural rigidity

Author(s): Michele, S., Zheng, S., Renzi, E., Borthwick, A.G.L., Greaves, D.M.

Questioner: Mike Meylan

Question(s) / Comment(s):

Do you think a green function method might be better for these kind of problems?

Did you validate your numerical solution?

Authors' Responses (use the back of the page if needed):

Definitely it is better method is 3D. I am doing that right now. Thanks.

Discussion Sheet

Paper title: Hydroelastic theory for offshore floating plates of variable flexural rigidity.

Author(s): Michele, S., Zheng, S., Renzi, E., Borthwick, A.G.L., Greaves, D.M.

Questioner: Richard Porter

Question(s) / Comment(s):

I wonder if you could explain how you derived the full expansion for $\phi^{(2)}$; in particular, how did you decide on the infinite series? Have you separated variables?

Authors' Responses (use the back of the page if needed):

Yes, I separated variables. $\phi^{(2)}$is the sum of a homogeneous solution (zero flux at the top and seabed) and the particular one. A similar approach is in Linton & McIver textbook 2.5.2 where the authors show the case of a heaving cylinder.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Hydroelastic theory for offshore floating plates of variable flexural rigidity

Author(s): Michele, S., Zheng, S., Renzi, E., Borthwick, A.G.L., Greaves, D.M..

Questioner: A. Korobkin

Question(s) / Comment(s):

You can use the paper by Khabakhpasheva and Korobkin (2002) “Hydroelastic behaviour of compound floating plate in waves” JEM, 44, 21-40 to cite other approaches to the same problem. Domain decomposition was not used in this paper.

Authors’ Responses (use the back of the page if needed):

I thank Prof. Korobkin, however I’d like to point out that the suggested paper by Khabakhpasheva and Korobkin (2002) is already cited in our published work on JFS about flexible plates of variable rigidity. I apologise if I didn’t mention Korobkin’s paper during the presentation.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Gravity wave interaction with a floating elastic plate in the presence of a pair of porous arc walls

Author(s): Negi, P., Sahoo, T., Meylan, M.H.

Questioner: Xingya Feng (SUSTech)

Question(s) / Comment(s):

Is this porosity parameter relevant to the geometry property of the porous arc walls.

Authors' Responses (use the back of the page if needed):

The flow across the breakwater is considered to flow the Darcy's Law. The porosity is introduced by making the holes on the arc wall. In real sense the porosity parameter depend on the structural material used to construct the wall and the size and radius of these holes. Finally, the porosity is introduced in the wall to decrease the wave forces on the floating platform.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Gravity wave interaction with a floating elastic plate in the presence of a pair of porous arc walls

Author(s): Negi, P., Sahoo, T., Meylan, M.H.

Questioner: Siming Zheng

Question(s) / Comment(s):

There are singularities at sharp edges of thin walls. How did you consider singularities at the edges of the arc walls?

Authors' Responses (use the back of the page if needed):

The singularities occurring at the sharp edges are integrable singularities. Thus, using the Gauss quadrature formula, these integrals are evaluated since the said formulae does not require the end data.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Electromagnetic precursors of Tsunamis

Author(s): Renzi, E., Mazza, M.G.

Questioner: Mike Meylan

Question(s) / Comment(s):

How could you extend this work to three-dimensions

Authors' Responses (use the back of the page if needed):

In three dimensions the fundamental dynamics governing the phased arrival of EM and tsunamis would be similar, but the propagation would occur in circular patterns at large distance from the epicenter. Mathematically, that entails using functions such as Bessel and Hankl, which is work in progress.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Experimental evaluation of nonlinear engineering approaches to model the springing and ringing responses of floating offshore wind TLPs

Author(s): Rongé, E., Peyrard, C., Venugopal, V., Benoit, M.

Questioner: Sime Malenica

Question(s) / Comment(s):

Your considerations on the importance of the drag. This is based on experimental observations, but the experiments are done of Froude scaled while the drag is driven by Reynolds number which is not the same at full scale.

Do you think that same conditions will remain at full side?

Authors' Responses (use the back of the page if needed):

It is true that at full scale the Reynold's number would be around three orders of magnitude higher. However, from CFD simulation which were carried out on the fixed TLP hull at full 10MW scale with monochromatic waves of the same steepness than in these experiments, it was also observed that there was a strong component of the third-order force emanating from the side buoys (fully submerged cylinders). This was thought to emanate from the drag force as the order of magnitude of those third-order amplitudes did not correspond to those expected from third-order Froude-Krylov diffraction forces and could be replicated well by using typical axial drag coefficient for submerged elements with sharp edges (CD ~ 1.5-4). I refer the reader to the following publication:

-Rongé, E., Peyrard, C., Venugopal, V., Xiao, Q., Johanning, L., \& Benoit, M. (2023). Evaluation of second and third-order numerical wave-loading models for floating offshore wind TLPs. Ocean Engineering, 288, 116064. doi:10.1016/j.oceaneng.2023.116064

The order of magnitude of these drag coefficient is quite typical, and the sensitivity to the drag coefficient of the third-order springing response at the pitch-tower bending mode, shown in the paper, shows that, in that range of drag coefficient values, the third-order pitch moment generated by drag is an exciting term. It is unlikely that even with very high Reynold's number, these coefficients would be one order of magnitude lower. Furthermore, as was shown in the presentation and I am reproducing the figures below, when the exciting drag term is removed from the simulation such as drag force is only a function of the structure velocity, the scalogram of the linear potential flow model loses the trace of ringing resonance whereas with exciting drag, that trace is present. This reinforces the conviction that drag will have a significant impact on third-order forces even at full scale on similar structure with large off-centre submerged elements.

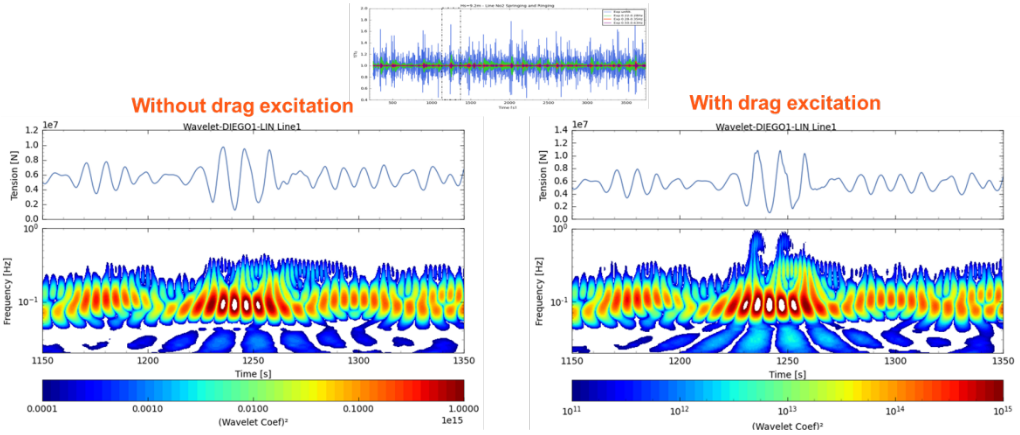


Figure. Time-frequency analysis via wavelet of ringing response on case EC2a (H_s = 9.2 m)

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Water entry of double-curvature specimens at high speed: effect of the transverse profile

Author(s): Spinosa, E., Grizzi, S., Iafrati, A.

Questioner: Kevin Maki

Question(s) / Comment(s):

Have you studied the transient dynamic in the cavity that appears to move forward at a speed that is several times greater than the speed of the body?

Authors' Responses (use the back of the page if needed):

Thanks for the very interesting question.

The dynamics of the ventilation area is harder to study compared to that of the cavitation zone. This is because, as observed, the ventilation front evolves much more rapidly.

From the video, with a careful analysis, it is possible to draw the edges of the ventilation area, as shown in Figure 15 of the paper IAFRATI and GRIZZI, PHYSIS OF FLUIDS, 2019. As it is possible to see, at the beginning the ventilation front has a curved shape that tends to evolve rapidly into a straight edge, parallel to the y-axis. (transverse axis). The speed of the ventilation front reaches up to 150 m/s at about =0.2 for the shape S3 at U=30 m/s i.e. more than three times faster than the horizontal test speed.

A possibility to derive more information on the dynamics of the ventilation front is to make use of the pressure data, similarly to what has been done for the study of the cavitation zone. An accurate estimate of the delay between the pressure time histories of the probes lying on the same horizontal/vertical lines can provide information on the shape and evolution of the ventilation front, focusing on the pressure fronts rising back to Patm. Although this task is harder than the study of the evolution of the cavitation zone, again due to the rapidity of the ventilation phenomenon, it will be considered for future activities.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Water entry of double-curvature specimens at high speed: effect of the transverse profile

Author(s): Spinosa, E., Grizzi, S., Iafrati, A.

Questioner: Alan Tassin

Question(s) / Comment(s):

For S2, after verification occurs, you mentioned that another phenomenon occurs. I am wondering whether this could just be a later stage during which the flow (and the free surface) is separated, similar to an air cavity behind a body entering water, at large penetration depth?

Authors' Responses (use the back of the page if needed):

It is not very easy to establish what happens after the ventilation front has reached back the location of the curvature change. One interpretation is that, once the cavity is filled with air, the air does not propagate further back, and a new cavitation area forms, with the model more submerged at this time. This is because the new brighter area looks very similar in shape to the first cavitation area that develops during the first part of the water entry. In addition, the front edge of this area has the same feature of the first cavitation area, being located again at the location of curvature change. More analyses on needed to confirm this hypothesis. All these phenomena occur very rapidly (within less than 0.1 s), which makes the interpretation even more complicated.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Third-Order First-Harmonic Wave Excitation Forces on Spherical Geometries.

Author(s): Tan, B., Orszaghova, J., Wolgamot, H., Kurniawan, A., Todalshaug, J.H.

Questioner: E. Renzi

Question(s) / Comment(s):

It seems that your 2nd and 3rd order effects are comparable, which would suggest that your Stokes expansion is not well ordered and your dynamics is beyond weakly nonlinear.

Can you please comment on that?

Authors' Responses (use the back of the page if needed):

We believe that our conditions are not beyond the weakly nonlinear regime where the Stokes' expansion is valid since the maximum wave steepness is $k_p A = 0.061$ which is still very mild. The reason that the 3rd-order forces are comparable to the 2nd-order forces is because the local dynamics are governed by volumetric effects

$$V(t) \simeq \frac{1}{3}\pi\left(2R^3 + 3R^2\eta(t) - \eta^3(t)\right),$$

where for a spherical geometry the 3rd-order forces are strongly excited. In general, even if the waves are 'well ordered' in the expansion, the forces are not necessarily ordered depending on the strength of the wave-to-force transfer functions.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Third-Order First-Harmonic Wave Excitation Forces on Spherical Geometries.

Author(s): Tan, B., Orszaghova, J., Wolgamot, H., Kurniawan, A., Todalshaug, J.H.

Questioner: Yonghwan Kim

Question(s) / Comment(s):

Thank you for an interesting presentation! I enjoyed it very much.

If the restoring force plays an important role, can we find an optimum shape near the mean water level (*which exploits these third-order terms advantageously*)?

Authors' Responses (use the back of the page if needed):

Thank you for your kind comment and I am glad you enjoyed the presentation.

If we seek a third-order first-harmonic component of the buoyancy force in phase with the linear component to effectively increase the first-harmonic force, the volumetric form (assuming long waves for a constant free surface across the body)

$$V(t) = C + \alpha\eta(t) \ + \beta\eta^2(t) + \gamma\eta^3(t), \qquad \alpha\gamma > 0,$$

is required, where C, α, β, γ are constants and only terms up to third-order are considered. For an axisymmetric geometry with a vertical profile $f(z)$, the volume can be found through a volume of revolution where the integration is taken from the deepest point $-d$ up to the wave elevation $\eta(t)$

$$\pi \int_{-d}^{\eta(t)} f^2(z)\,\mathrm{d}z = C + \alpha\eta(t) \ + \beta\eta^2(t) + \gamma\eta^3(t), \qquad \alpha\gamma > 0.$$

We can easily define a solution to the integral (note that constant coefficients are absorbed arbitrarily)

$$f^2(z) = \frac{\mathrm{d}h(z)}{\mathrm{d}z},$$

$$h(z) = C + \alpha z \ + \beta z^2 + \gamma z^3, \qquad \alpha\gamma > 0,$$

$$\frac{\mathrm{d}h(z)}{\mathrm{d}z} = \alpha \ + \beta z + \gamma z^2, \qquad \alpha\gamma > 0,$$

$$f(z) = \sqrt{\alpha \ + \beta z + \gamma z^2}, \qquad \alpha\gamma > 0,$$

For example, the following simple linear profile (which forms a conical volume)

$$f(z) = \sqrt{1 + 2z + z^2} = 1 + z, \qquad \alpha\gamma > 0$$

$$V(t) = \pi \int_{-d}^{\eta(t)} 1 + 2z + z^2 \, \mathrm{d}z,$$

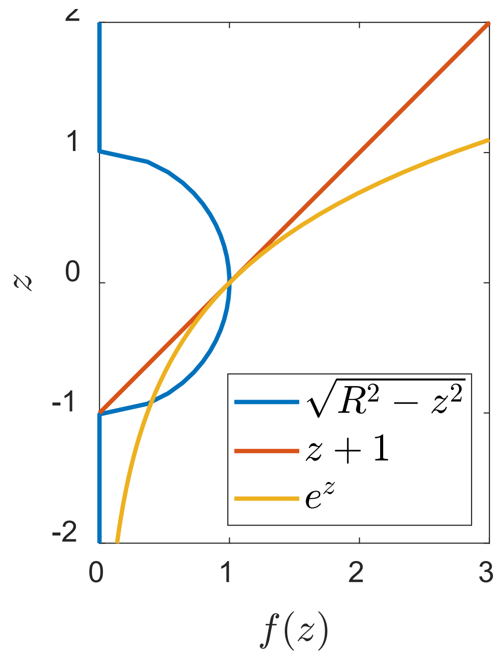
$$V(t) = \pi \left(d \left(1 - d + \frac{1}{3} d^2 \right) + \eta(t) + \eta^2(t) + \frac{1}{3} \eta^3(t) \right).$$

So, a cone always has 1st- and 3rd-order buoyancy forces in phase. Whereas a circular profile with radius R (which forms a spherical volume)

$$f(z) = \sqrt{R^2 - z^2}, \qquad \alpha\gamma < 0$$

$$V(t) = \pi \left(d \left(R^2 - \frac{1}{3} d^2 \right) + R^2 \eta(t) - \frac{1}{3} \eta^3(t) \right),$$

always has 1st- and 3rd-order buoyancy forces out of phase (provided the free surface is effectively constant over the body). In general, profiles which are not explicitly polynomial, such as $f(z) = e^z$, can also be expanded in a power series to obtain the required form but this is not shown explicitly here. See a plot of the discussed profiles below. Volume is found by revolving around the vertical axis.



Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Very Large Floating Structure (VLFS) interacting with water waves: large scale laboratory experiments and numerical modelling

Author(s): Tassin, A., Cognet, V., Eddi, A., Fermigier, M.

Questioner: Mike Meylna

Question(s) / Comment(s):

Extracting the dispersion relation requires Fourier transforms in space and time. How did you do this?

Authors' Responses (use the back of the page if needed):

Indeed. We process in several steps:

1) We average the deflection of the plate in the transverse direction

2) We separate the incident and the reflected wave components in the plate

3) For irregular waves, for each frequency, we identify the wave number which has the higher magnitude.

4) For regular waves, we compute the spatial Fourier transforms at each time step and the we identify the wave number with maximum magnitude, and we average in time

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Very Large Floating Structure (VLFS) interacting with water waves: large scale laboratory experiments and numerical modelling

Author(s): Tassin, A., Cognet, V., Eddi, A., Fermigier, M.

Questioner: T. Khabakhpasheva

Question(s) / Comment(s):

Did you observe some variations of plate deflections across the channel, which correspond of different shape of propagating waves.

Authors' Responses (use the back of the page if needed):

Yes, in the experiments, there is some transversal deflection. However, we believe that the irregularities that we observe in the dispersion relation are due to gap resonance between the plate and the walls of the tank. Indeed, similar results are observed in the numerical results where the walls of the tank are taken into account despite the fact that the transversal deflection is neglected.

Discussion Sheet

The 39th International Workshop on
Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Very Large Floating Structure (VLFS) interacting with water waves: large scale laboratory experiments and numerical modelling.

Author(s): Tassin, A., Cognet, V., Eddi, A., Fermigier, M.

Questioner: R.C. Ertekin, University of Hawaii & Harbin Engineering University

Question(s) / Comment(s):

The size of the plate in comparison with tank size is very large. There will be reflections from all four sides of the tank, not just from the wavemaker. How confident can you be on the experimental data because of these reflections? Thank you.

Authors' Responses (use the back of the page if needed):

Indeed, the lateral walls of the tank have an effect on the results. This is not an issue because the lateral walls are modelled in the hydrodynamic computations carried out with Hydrostar. The waves which are reflected towards the wave maker are also not a problem because we select a suitable time window in the analysis so that the waves which are reflected on the wave maker don't have time to come back to the structure.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Equilibrium array configurations with respect to the deviatoric mean drift forces

Author(s): Tokic, G., Yue, D.K.-P.

Questioner: Henrik Bredmose

Question(s) / Comment(s):

Thanks for the presentation! Given that the theory is for monochromatic waves in a fixed direction, can you comment as to how you see it applied for a real array? How close should the array members be for the deviatoric force to be as strong as the single-body drift force?

Authors' Responses (use the back of the page if needed):

We thank Prof. Bredmose for very insightful questions. Indeed, the equilibrium configurations we obtain are strictly valid only in monochromatic seas. As the equilibrium configurations are dependent on the incident wavenumber and direction, it is unlikely that there will be true equilibrium configurations for general broadband seas. For very narrow-banded long-crested seas, one could expect that the bodies would oscillate around the equilibrium configuration for the peak wavenumber. Therefore, these results could apply to design and/or operation of real arrays in cases when they are exposed to predominant swell conditions.

Regarding the second question, the deviatoric force is generally of oscillatory character, with its magnitude increasing as the scattering increases. In general, it is also larger the closer the bodies are. For a two-body array, for example, it oscillates around zero with the magnitude on the order of the downwave mean drift force on an isolated cylinder. For an incident wave of wavenumber ka = 1.2 (red line in Figure 1), for example, the deviatoric force will be larger than the downwave mean drift force on an isolated cylinder if two cylinders are spaced less than 1.4 diameter apart. For the same incident wave, the deviatoric force is still half of the downwave mean drift force when the cylinders are spaced as far as 4 or 6.5 diameters apart.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Equilibrium array configurations with respect to the deviatoric mean drift forces

Author(s): Tokic, G., Yue, D.K.-P.

Questioner: Bernard Molin

Question(s) / Comment(s):

You assume the bodies to be fixed. What will happen if they are free to move to respond to the waves? Due to proximity effects, their first-order responses will be different, except maybe for some particular spacings. Do you expect that there will be configurations where the deviatoric components of the drift force are nil?

Authors' Responses (use the back of the page if needed):

We thank Prof. Molin for his insightful comments. If the bodies are free to move, the wavefield around the bodies will, indeed, be different, and there will be an additional component to the mean drift force resulting from the body motion. However, the first-order motion response does not qualitatively change the analysis regarding the equilibrium configurations, and we expect that equilibrium configurations still exist even if bodies are oscillating in waves (although they will not be the same as for fixed bodies). If we consider the wavefield away from a body in an array, the effect of the body motion is only reflected in the changed amplitude and phase of the partial wave propagating away from the body. This could be considered as pure scattering off a fixed body of different geometry. Substantially, this is an equivalent situation to the one we consider

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: A high-order shifted boundary method for water waves and floating bodies

Author(s): Visbech, J., Engsig-Karup, A., Bingham, H.B., Amini-Afshar, M., Ricchiuto, M.

Questioner: Xinya Feng (SUStech)

Question(s) / Comment(s):

Apparently, BEM is a classic numerical method for dealing with fully nonlinear potential flow problem. The issue is the instability problem when the structure is surface piercing and there is an intersection line between bodies and surface. How can the shifted BEM be applied to deal with the intersection line?

Authors' Responses (use the back of the page if needed):

We have not yet done work with surface pieing object. However, pure numerical work have been done for boundary with intersections of Dirichlet and Neumman-type conditions. No problem here.

Discussion Sheet

The 39[th] International Workshop on Water Waves and Floating Bodies
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Paper title: A high-order shifted boundary method for water waves and floating bodies

Author(s): Visbech, J., Engsig-Karup, A., Bingham, H.B., Amini-Afshar, M., Ricchiuto, M.

Questioner: G. Ducrozet

Question(s) / Comment(s):

What is the main parameter controlling convergence of the model? Is it the only distance between surrogate boundary and real one or does the curvature of the real boundary plays a role for instance?

What is the additional numerical complexity induced by this approach compared to a "classical" one?

Authors' Responses (use the back of the page if needed):

First question) As curved geometrical features in the SBM-approach is represented to the same order as the approximation/truncation errors, the only two parameter is n and p that control convergence. This is just like a standard SEM on boundary-fitter meshes.

Second question) The level set evaluation, updating of the system-matrix and imposing more weak boundary terms. Still better than remeshing/updating mesh.

Discussion Sheet

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Paper title: A high-order shifted boundary method for water waves and floating bodies

Author(s): Visbech, J., Engsig-Karup, A., Bingham, H.B., Amini-Afshar, M., Ricchiuto, M.

Questioner: Yonghwan Kim

Question(s) / Comment(s):

The reason why body fitted mesh is to capture strong variation of flow near the body surface or fluid boundary.

Do you think that using the same/fixed meshes in fluid domain can capture such strong variation near boundary?

Authors' Responses (use the back of the page if needed):

Yes, the SEM+SBM approach should be able to capture this. We have performed simulation of deforming, curved, and time-depended free surface boundaries on a very simple time-invariant mesh.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Numerical study of the suction effect during the freak wave slamming with an FDM model with enhanced momentum conservation treatment

Author(s): Wang, X., Reeve, D.E., Luo, M., Karunarathna, H.

Questioner: Zhilong Wei (DTU)

Question(s) / Comment(s):

1. mass conservation of level set, some hybrid, VOF-LS method.

2. Air compressibility when air is trapped in the water.

Authors' Responses (use the back of the page if needed):

1. To use find grid to capture the droplets.

2. Will consider that.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Evaluating instantaneous crest phase speed in multi-directional seas through Hilbert transform

Author(s): Wang, Y., Ducrozet, G.

Questioner: Chen X.B.

Question(s) / Comment(s):

Congratulation for your nice work! My question is about your preference to use SHTM instead of THTM to complete crest plane speed?

Another question, could you complete this group velocity using the phase function observed by SHTM?

Authors' Responses (use the back of the page if needed):

Q1: Thank you! From practical standpoint of view, the SHTM is more practical for our application because the THTM needs the free surface information at every time step.

Q2: Yes, it's possible to compute group velocity by using the phase function obtained by SHTM. In fact, it can be compared by taking temporal derivative to the local wave number, then taking the spatial derivative to the cylinder frequency the group velocity found.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: A fully explicit wave-vegetation interaction model and its application in waves over a floating seaweed farm

Author(s): Wei, Z., Shao, Y., Kristiansen, T., Kristiansen, D.

Questioner: John Grue

Question(s) / Comment(s):

There is an ongoing scientific discussion regarding shear-induced instability due to the wave/seaweed interaction. Does this occur in the cases which you model?

Authors' Responses (use the back of the page if needed):

Yes, if the canopy is dense enough, there might be KH instability happening near the interface between the canopy and water volume. But for a seaweed farm, the distance between two longlines is much larger than the seaweed length. So the answer is no. KH instability doesn't (at least as the author knows) happen.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Aerated wave impacts on an overhang: simulations and experiments

Author(s): Wellens, P.R., van der Eijk, M

Questioner: A. Korobkin

Question(s) / Comment(s):

Iafrati, Korobkin; Breaking wave impact with aeration. Hydroelasticity Conference. 2006, Wuxi

Strains in an elastic wall is independent of aeration level. This was a result of that study. Later the model was extended to sloshing (together with BV, Malenica, Ten). If you are not concerned with hydroelasticity, what are you concerned with and why?

Authors' Responses (use the back of the page if needed):

PRW: Thank you for the reference and for the question. We'll include the reference in future communication. Strains were not measured in the experiment we presented. Both the sloshing tank and the structural geometry inside the tank were constructed very rigidly making the setup very stiff. We measured impact pressures on the overhang. The intention of the experiment was to find the effect of different levels of aeration in the water (1%, 2%, 4% by volume) on the impact pressure. The amount of entrained air in the water was found to have a significant effect on the impact pressure. The experimental results in terms of pressure are intended for validation of a numerical model. In the end, the purpose of developing experiments and numerical methods in this way, is to account for the presence of entrained air in water when breaking waves impact with an offshore structure at sea.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Effects of wave-current coupled interaction on dynamic responses of a spar-type floating wind turbine under wind-wave misalignment

Author(s): Xin, Z., Li, X., Li, Y

Questioner: H. Bredmose

Question(s) / Comment(s):

Thanks for a good presentation. I wanted to comment on the yaw motion that is caused by combined roll and trust. The roll results from the varying generator moment in the rotor speed regulation.

Authors' Responses (use the back of the page if needed):

Thank you very much for your comment.

May I take a moment of your time? I was wondering why the generator still generates significant roll torque when the wind is right against the plane where the blades are.

Thank you for your consideration and looking forward to hearing from you.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Effects of wave-current coupled interaction on dynamic responses of a spar-type floating wind turbine under wind-wave misalignment

Author(s): Xin Z., Xin Li, Yan Li

Questioner: Baoyi Ni(HEU)

Question(s) / Comment(s):

1. Did you consider the coupling model of wind and wave?
2. It is suggested to describe how the de-coupled wave and current model in more details.

Authors' Responses (use the back of the page if needed):

Thanks for your questions and comments.

1.I have considered the coupled interaction between winds and waves based on the OpenFast when studying the dynamic responses of a spar-type floating wind turbine.

2.The wave-current decoupling means that the waves cannot 'feel' the presence of current and the characteristics of waves are not affected by the current.

Thank you for your consideration.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Long wave interaction with a moored elastic plate floating near an inclined beach

Author(s): Yang, Y., Ren, K., Huang, L., Meylan, M.H.

Questioner: A. Korobkin

Question(s) / Comment(s):

My experience shows that it is very complicated these days to receive support for linear models of floating plates in waves. Nonlinear models with over washing, slamming and breaking of mooring lines are of demand. How can you justify using a linear model in your analysis for practical problems of risk assessment?

Authors' Responses (use the back of the page if needed):

Many thanks for your comments. We fully understand the importance of the nonlinearity, this is also we planned to discuss later. For the linearized solution, we intended to establish some key features of the phenomenon, e.g. when the wave elevation could be large, which may need to be re-considered by the nonlinear model.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Long wave interaction with a moored elastic plate floating near an inclined beach

Author(s): Yang, Y., Ren, K., Huang, L., Meylan, M.H.

Questioner: Hui Liang

Question(s) / Comment(s):

Why evanescent modes are ignored in the region underneath the elastic plate?

Authors' Responses (use the back of the page if needed):

Many thanks for the reviewer's comment. Here is our explanation, floating solar panels are normally arranged in shallow water environments in the current stage or the area near the beach shore. Such environments always with a shallow water depth, in such a case, we may apply the shallow water assumption to the governing equations and boundary conditions. The resulting dispersion equation shows that only the traveling wave components need to be maintained here, but the attenuation wave components disappear. In fact, from the aspect of physics, waves in shallow water environments normally propagate its energy by traveling waves, the attenuated energy is quite limited.

We really hope our response makes the reviewer satisfied.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Upstream waves and wake waves induced by a travelling pressure distribution with dynamic correction

Author(s): Jinyu Yao, Harry B. Bingham, Xiushu Zhang

Questioner: John Grue

Question(s) / Comment(s):

Thank you for presenting very good work including experiments in the laboratory and modelling/calculation. I have three comments to your result comparing static and dynamic moving pressures:

1. When the displacement is conserved, the effect of the two are equivalent, as regards the amplitude of the mini tsunami.

2. The results in figure 4 of the abstract are for a very narrow tank. With reference to Grue 2017, figure 7, for $\Delta h/h_0$=0.909, same as in your experiment, the calculated amplitude relevant to the field condition is $\eta/u=10^{-3}$, while in your figure 4, the ratio is 2.10^{-2}, which is a factor of 20 in difference, and which explaining why dynamical effects modify the picture.

Please correct point 2, on line 4:
From η/u
To: η/h_0

3. In Grue (2020), I calculated the difference between 7 static pressure distribution and a physical slip. With regard to the upstream wave, there is no difference between the two.

Authors' Responses (use the back of the page if needed):

Thank you very much for your comments. I agree that the difference in amplitudes results from the different channel width we use, because in Yao etal (PRF,2023), we simulated the mini-tsunamis in both narrow and wide channels and found the amplitude in a narrow channel (channel width to ship width ratio W/B=4) is much larger than that in a wide channel (W/B=20), and the nonlinear effects on mini-tsunamis are also more significant. However, for the effects of dynamic correction on mini-tsunamis, we just studied them in a narrow channel where the effects are significant. I guess the effects of dynamic correction are less significant in a wide channel, because I studied the effects on solitons over a flat bottom in a wide channel (W/B=20) and found the effects of dynamic correct on upstream solitons are minor. Instead, the effects of dynamic correction on wake waves are much more significant than those on upstream waves. Maybe in the future, we can conduct a series of model experiments to study the effects of nonlinearity and dynamic correction on mini-tsunamis in narrow and wide channels in detail. Thanks for your helpful comments again!

Discussion Sheet

Paper title: Upstream waves and wake waves induced by a travelling pressure distribution with dynamic correction

Author(s): Yao, J., Bingham, H.B., Zhang, X.

Questioner: Hui Liang

Question(s) / Comment(s):

Besides the upstream mini-tsunamis. I wonder if you have considered the interactions between wake waves and the step? High-order harmonic components will be triggered.

Authors' Responses (use the back of the page if needed):

Thank you very much for your questions. For wake waves, I just studied them over a flat bottom. In test cases with a variable bottom, the amplitudes of mini-tsunamis are much significant than those of wake waves, and we mainly focus on mini-tsunamis now. But it seems to be convenient to study the wake waves over a variable bottom by HOS-VB, we can try to investigate the interaction of wake waves and the step in the future.

Discussion Sheet

The 39th International Workshop on
Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Upstream waves and wake waves induced by a travelling pressure distribution with dynamic correction

Author(s): Yao, J., Bingham, H.B., Zhang, X.

Questioner: G. Ducrozet

Question(s) / Comment(s):

The step you consider looks rather steep while the method you use is limited to 'not too steep' bottom variation. Do you have any comments on that?

Authors' Responses (use the back of the page if needed):

Thank you very much for the question. I have read your papers about HOS-VB in 2016 and 2017, the assumption that β/h_o<<1 is made cβ is a depth correction function, h_o is the mean water depts and convergent test of β/h_o is conducted. Convergence is still shown when β/h_o=0.5. in my research, the water depths in the shallow the deep water are 30m and 80m, respectively, so $\beta/h_o \approx 0.45$. We compared our numerical results with radar measurement from Prof. Grue, and found they are comparable, so I think HOS-VB is still suitable for our test cases, even though $\beta/h_o \approx 0.45$ instead of β/h_o<<1. The results are more accurate when β/h_o is smaller. However, I have not studied the maximum limit of β/h_o in HOS-VB, maybe I can study this in the future. In addition, I found the bottom slope will affect the stability of HOS-VB. When a small number of β/h_o is used, HOS-VB still breaks down with a steep slope. Thanks again for your questions!

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Upstream waves and wake waves induced by a travelling pressure distribution with dynamic correction

Author(s): Yao, J., Bingham, H.B., Zhang, X.

Questioner: R. Cengiz Ertekin

Question(s) / Comment(s):

This phenomenon could occur in rather shallower waters and in bounded (laterally) waters, i.e., in a channel. Therefore, the blockage coefficient plays a significant role. The Froude number could be very small for this to occur if the blockage coefficient is high. Kelvin waves, in the wake region which made 19.2° with the centerline in deep waters becomes longer and longer as the water depth becomes shallower. Finally, the wave crest in the wake region hits the sidewall, a Mach stem occurs, and the nonlinear waves run away, i.e. upstream solitons observed.

Authors' Responses (use the back of the page if needed):

Thank you very much for the comments. I have read your papers about solitons, such as the conference paper in 1984, JFM paper in 1986, and your thesis. The wave resistance and characteristics of solitons different blockage coefficient were studied and importance of this coefficient was illustrated. In the future, I think we can set some cases with different blockage coefficients, and investigate the upstream waves and wake waves in these cases with a flat bottom or a variable bottom. Thanks again for your comments!

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Hydrodynamic characteristics investigation of multiple floating bodies under phase control

Author(s): Yu, S.-R., Yuan, Z.-M

Questioner: Bo Woo Nam (Seoul National University)

Question(s) / Comment(s):

1. Why is a kind of discrete control used for your study rather than continuous control method?

2.Is the wave energy extraction (absorption) based on relative pitch motion not the L_2-norm of pitch motion of each body?

Authors' Responses (use the back of the page if needed):

1. The discrete control is a simple but effective way of controlling, which is widely applied in vibration control and WEC control. It can be applied by simply opening and closing a by-pass value in PTO. This is more energy-saving than continuous control method, which usually requires the use of active control devices.

2. Yes, the wave energy extraction should be $J_4 = \frac{1}{T}\int_0^T B_d\theta^2 dt$ which is related to the relative pitch motion θ. The name of "wave energy absorption" of J_2 might be misleading.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Nonlinear free-surface responses in three-dimensional moonpools with recess

Author(s): Zhang, X., Chu, B.

Questioner: Hugh WOLGAMOT

Question(s) / Comment(s):

Very nice results. You could see more harmonic structure if you use frequency filtering to separate 1st, 5th, 9th harmonics (and similar for 2nd, 6th, etc).

Authors' Responses (use the back of the page if needed):

Thanks a lot for your suggestions and encouragement. We will try to separate 1st , 5th, 9th harmonics, and others using digital filtering.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Nonlinear free-surface responses in three-dimensional moonpools with recess

Author(s): Zhang, X., Chu, B.

Questioner: Hui Liang

Question(s) / Comment(s):

1. Soft or hard spring effects depend on the water depth. You may compare the water depth with the 'critical depth'.

2. The asymmetric mode might be excited by mode interactions near the natural frequency. You could look into the sloshing behaviors via comparing the phase at different wave gauges obtained from STFT or wavelet transform.

Authors' Responses (use the back of the page if needed):

R1:Yes. Thanks for your suggestion. We have checked the critical depth. The finding is consistent with that for sloshing in closed tank.

R2: Thanks for your suggestion. We will try wavelet analyses. But we think that the asymmetry is triggered by the antisymmetric sloshing modes.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Effects of a ship moving in a lead between flexible ice sheets

Author(s): Zhang, Z., Beck, R.F., Maki, K.J

Questioner: Baoyu Ni

Question(s) / Comment(s):

How do you solve the fully coupled CFD and FEA framework? For example, how about the meshes on the structure & CFD domain? How about the time steps for structural and fluid domain? How many steps do you take before the fully coupled FSI converges? Thank you very much for your presentation and sharing the techniques.

Authors' Responses (use the back of the page if needed):

We use Abaqus to perform frequency extraction. Then we read modes and frequencies into CFD solver. The solve is segregates, and we require 3 iterators per time step.

See details in Prio & Maki 2013 JFS, or the thesis by Dominic Piro at U of M, available on the deep blue repository.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Effects of a ship moving in a lead between flexible ice sheets

Author(s): Zhang, Z., Beck, R.F., Maki, K.J

Questioner: Simone Michele

Question(s) / Comment(s):

Could you explain more in details your FE modeling of the ice? Do you account for ice vibrations during the simulations? Is this effect really important? It could be interesting to compare quasi static and dynamic model of ice! I have the feeling that ice dynamics could be neglected (not sure) which will lead to much simpler problem. This waves, you can consider the rigid body ice for the flow solver and evaluate be deflection in the second step by quasi static approach.

Authors' Responses (use the back of the page if needed):

We use a dynamic FE and solve the coupled fluid-structure system in the time domain. I don't think ice inertia may always be important, although I am not sure. If its not, then your suggestion for a steady solve would be more efficient. On the after hand, added mass is not small, so we are much more comfortable to include it.

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies

St Andrews, Scotland, 14-17 April 2024

Paper title: Hydrodynamic performance of a U-shaped oscillating water column consisting of a flexible bottom-standing front wall

Author(s): Zheng, S., Michele, S., Lee, Y.C., Greaves, D.

Questioner: Malin Goteman

Question(s) / Comment(s):

Are the large resonances obtained comparable with the assumptions of the linear potential flow theory and have you studied the system also using high-fidelity methods? And nice work by the way :)

Authors' Responses (use the back of the page if needed):

Our present model is developed based on the linear potential flow theory. I agree that the response of the device could be over predicted, especially when large resonances happen, because of the reflection of the fluid viscosity. In spite of this, we believe the model is meaningful to predict the frequencies when large resonances could happen. We haven't applied other high-fidelity methods yet. Thanks to the audience for their kind reminder, the present model could be extended by introduce artificial damping to take wave power dissipation into account.

Thank you for your questions and comments. :)

Discussion Sheet

The 39th International Workshop on Water Waves and Floating Bodies
St Andrews, Scotland, 14-17 April 2024

Paper title: Hydrodynamic performance of a U-shaped oscillating water column consisting of a flexible bottom-standing front wall

Author(s): Zheng, S., Michele, S., Lee, Y.C., Greaves, D.

Questioner: Harry Bingham

Question(s) / Comment(s):

Very interesting that you can improve the performance by making the front wall flexible. I wonder though what material you would choose for this in practice? I would be concerned about fatigue, since it will have to service many cycles over a lifetime of say 20 years.

Authors' Responses (use the back of the page if needed):

Thank you for your comment and question. I agree that fatigue is important in practice and it would be a big challenge to find a suitable material. Yet this is out of our research scope. Our present study is focused on hydrodynamics and we would like to leave the material-related study for future work.

Scott Russell's Great Wave of Translation

In 1995, a solitary wave was recreated on the Union Canal near Edinburgh, the same location where J.S. Russell observed the 'first' soliton in 1834. Photo © Heriot-Watt University, Scotland