14:24–Function Hall A

Simulation of the interaction between compressible fluid and thin elastic plate by the modified ghost fluid method

Liang Xu[*,**,†], *Tiegang Liu*[*], *Zhangyong Ni*[**]
[*]*LMIB and School of Mathematics and Systems Science, Beijing University of Aeronautics and Astronautics, Beijing, China*
[**]*China Academy of Aerospace Aerodynamics, Beijing, China*

This work is devoted to extending the modified ghost fluid method (MGFM) to treat compressible fluid coupled with thin elastic plate and applying it to the underwater explosions (UNDEX) problem. By solving shock relationship and thin-elastic-plate equation together to predict the ghost fluid states and the plate load, this approach not only ensures numerical stability and maintains the advantages of simplicity and high efficiency, but also provides a more accurate interface boundary condition. Evolution of strong shock impacting on thin elastic plate and dynamic response of the plate are investigated. Results disclose that the MGFM provides a convenient and effective way for handling the coupling between flow and plate.

xuliang@smss.buaa.edu.cn

14:27–Function Hall A

Computations of drag force on cylinder in oscillatory viscous flow, and comparison to experiments

John Grue[†], *Magnus Vartdal*
Mechanics Division, Department of Mathematics, University of Oslo, Oslo, Norway

Finite volume computations with LES/Dynamic Smagorinsky turbulence closure of drag and inertia coefficients on a cylinder oscillating in viscous fluid, with beta number 11 240, Keulegan–Carpenter (KC) number up to 4, and Reynolds number up to 45 000, show strong agreement with a set of experiments by Otter but strong disagreement with a set of experiments by Sarpkaya. Simulations illustrate that flow separation causes the drag coefficient to depart from the classical Stokes–Wang solution. The scale results are relevant to ocean basin model tests of offshore wind turbines. With KC up to 3 and high beta, the drag force is negligible in comparison to the inertia force. For larger KC and high beta, flow separation contributes with an essential drag force. The drag coefficient is comparatively higher in a moderate scale range with $\beta = 1\,035$. In the range where the Honji instability is present there is no change in the force before and after the instability sets in.

johng@math.uio.no

14:30–Function Hall A

An adaptive immersed boundary method for fluid structure interaction with boundary mass

Wenquan Wang, Dongwei Hao, Yan Yan[†]
Department of Engineering Mechanics, Kunming University of Science and Technology, Kunming, China

The immersed boundary method has been widely applied to problems involving a moving elastic boundary that is immersed in fluid and interacting with it. But most of the previous applications of the IB method have involved a massless elastic boundary and used efficient Fourier transform methods for the numerical solutions. Extending the method to cover the case of a massive boundary has required spreading the boundary mass out onto the fluid grid and then solving the Navier–Stokes equations with a variable mass density. Here we propose a new and simple way to give mass to the elastic boundary and show that the new method can be applied to many problems for which the boundary mass is important. The new method does not spread mass to the fluid grid, and is easy to implement in the context of an existing IB method code for the massless case.

yanyankm@126.com

14:33–Function Hall A

Investigation of traveling wave in vortex-induced vibrations of long flexible cylinders

Xiaodong Wu, Fei Ge, Youshi Hong[†]
State Key Laboratory of Nonlinear Mechanics, Institute of Mechanics, Chinese Academy of Sciences, Beijing, China

The respective contributions of traveling and standing vibration waves to overall vibration waves are investigated in this paper. Two methods are presented and expanded for the identification of traveling and standing vibration waves. One is a parametric method based on fitting an ellipse to the complex spatial amplitude distribution. The other is a non-parametric method based on the Hilbert transform. The parametric method was used to compute the ratio values between traveling and standing vibration waves in predicted displacement responses. An experiment was conducted to study the individual contributions of each type of vibration wave. Then the non-parametric method was used to separate the traveling and standing wave components in measured vortex-induced vibration (VIV) responses. It was found that the two methods worked very well and results show that the ratio value of traveling wave component increases with the velocity, indicating that traveling wave plays a more important role in VIV responses of long flexible structures in ocean engineering.

hongys@imech.ac.cn

14:36–Function Hall A

Wave interaction with two elastically mounted vertical cylinders

Wei Su[*], *Jiemin Zhan*[**,†], *Yoksheung Li*[+]
[*]*School of Engineering, Sun Yat Sen University, Guangzhou, China*
[**]*Department of Applied Mechanics and Engineering, School of Engineering, Sun Yat Sen University, Guangzhou, China*
[+]*Dept. of Civil and Structural Engineering, The Hong Kong Polytechnic University, Hong Kong, China*

The interaction of water waves with two elastically mounted vertical cylinders is studied both theoretically and experimentally. Under the assumptions of potential flow and linear wave theory, the multi-pole expansion method has been employed to obtain the