Kai Zhang (张 凯)

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Research Interests

- Bluff Body Aerodynamics
- Computational Fluid Dynamics (CFD)
- Flow Control
- Reduced Order Modeling
- Data-driven Analysis
- Modal/Non-modal Analysis

Education

Yokohama National University, Yokohama, Japan
Doctor of Engineering, Civil Engineering, 2014-2017

Yokohama National University, Yokohama, Japan
M.S., Civil Engineering, 2012-2014

Shanghai Jiao Tong University, Shanghai, China
M.S. candidate, Civil Engineering, 2011-2012

Xi'an Jiao Tong University, Xi'an, China
B.S. candidate, Civil Engineering, 2011-2012

Appointments

Shanghai Jiao Tong University, Shanghai, China

- Associate Professor, 2022/02 - present
  School of Naval Architecture, Ocean and Civil Engineering

Rutgers, The State University of New Jersey, Piscataway, NJ, USA

- Postdoctoral Associate, 2020/03-2022/01
  Department of Mechanical and Aerospace Engineering

University of California, Los Angeles, CA, USA

- Postdoctoral Associate, 2019/01-2020/02
  Department of Mechanical and Aerospace Engineering

Florida State University, Tallahassee, FL, USA

- Postdoctoral Research Associate, 2017/11 - 2018/12
  Department of Aerospace and Mechanical Engineering

Academic Services & Memberships

- **Journal Referee**
  - AIAA Journal
  - Theoretical and Computational Fluid Dynamics
  - Physics of Fluids
  - Journal of Fluids Engineering
  - China Ocean Engineering
  - Fluids

Publications

Journal Articles († invited)

In Review

27. Zhang, K.*, Taira, K. (2021) Laminar vortex dynamics around forward-swept wings. Sumbitted to ***Journal of Fluid Mechanics***.
26. Zhang, K.*, Shah, B. and Bilgen, O. (2021) Low-Reynolds-number aerodynamic characteristics of airfoils with piezocomposite trailing control surfaces. Submitted to ***AIAA Journal***.
25. Burtsev, A., He, W., Hayostek, S., Zhang, K., Theofilis, V., Taira, K. & Amitay, M. (2021) Linear modal instabilities around post-stall swept finite aspect ratio wings at low Reynolds numbers. In review.
24. Hayostek, S., Zhang, K., Taira, K., Burtsev, A., He, W., Theofilis, V. & Amitay, M. (2021). Vortical Interactions on Low Aspect Ratio Wings at Low Reynolds numbers. In review.

2021

23. Ping, H., Zhu, H., Zhang, K., Zhou, D., Bao, Y. and Han, Z. (2021). Vortex-induced vibrations of two rigidly coupled circular cylinders of unequal diameters at low Reynolds number. ***Physics of Fluids***, accepted.
22. Fukami, K., Murata, T., Zhang, K. & Fukagata, K. (2021). Sparse identification of nonlinear dynamics with low-dimensionalized flow representations. ***Journal of Fluid Mechanics***, 926, A10.
21. Morimoto, M., Fukami, K., Zhang, K., Nair, A. G. & Fukagata, K. (2021). Convolutional neural networks for fluid flow analysis: toward effective metamodeling and low-dimensionalization. ***Theoretical and Computational Fluid Dynamics****, 35, 633–658.*.
20. Morimoto, M., Fukami, K., Zhang, K. & Fukagata, K. (2020). Toward practical uses of neural networks for fluid flow estimation. ***Neural Computing and Applications***, accepted.
19. Ping, H., Zhu, H., Zhang, K., Zhou, D., Bao, Y., Xu, Y. & Han, Z. (2021). Dynamic mode decomposition based analysis of flow past a transversely oscillating cylinder. ***Physics of Fluids***, 33, 033604.
18. Zhang, Z., Tu, J., Zhang, K., Yang, H., Han, Z., Zhou, D., Xu, J. & Zhang, M. (2021). Vortex characteristics and flow-induced forces of the wavy cylinder at a subcritical Reynolds number. ***Ocean Engineering***, 222, 108593.

2020

17. Chen, Y., Dong, Z., Wang, Y., Su, J., Zhou, D., Zhang, K., Zhao, Y., Bao, Y. & Han, Z. (2020). Short-term wind speed predicting framework based on EEMD-GA-LSTM method under large scaled wind history. ***Energy Conversion and Management***, 227, 113559.
16. Ping, H., Zhu, H., Zhang, K., Wang, R., Zhou, D., Bao, Y. & Han, Z. (2020). Wake dynamics behind a rotary oscillating cylinder analyzed with proper orthogonal decomposition. ***Ocean Engineering***, 218, 108185.

15. Zhang, K.*, Hayostek, S., Amitay, M., Burtsev, A., Theofilis, V., & Taira, K. (2020). Laminar separated flows over finite-aspect-ratio swept wings. ***Journal of Fluid Mechanics***, 905, R1.

14. Zhang, K., Zhou, D., Katsuchi, H., Yamada, H., Han, Z., & Bao, Y. (2020). Bistable states in the wake of a wavy cylinder. ***Physics of Fluids***, 32(7), 074112.

13. Zhang, K.*, Hayostek, S., Amitay, M., He, W., Theofilis, V., & Taira, K. (2020). On the formation of three-dimensional separated flows over wings under tip effects. ***Journal of Fluid Mechanics***, 895, A9.

2018

12. 平焕, 张凯, 周岱, 包艳, 朱宏博, & 韩兆龙. (2018). 低雷诺数下直圆柱和波型圆柱受迫振动的数值研究. ***振动与冲击***, 23, 2.

11. Zhang, K., Katsuchi, H., Zhou, D., Yamada, H., Bao, Y., Han, Z., & Zhu, H. (2018). Numerical study of flow past a transversely oscillating wavy cylinder at Re= 5000. ***Ocean Engineering***, 169, 539-550.

10. Zhang, K., Katsuchi, H., Zhou, D., Yamada, H., & Lu, J. (2018). Large eddy simulation of flow over inclined wavy cylinders. ***Journal of Fluids and Structures***, 80, 179-198.

9. Ma, N., Lei, H., Han, Z., Zhou, D., Bao, Y., Zhang, K., Zhou, L., & Chen, C. (2018). Airfoil optimization to improve power performance of a high-solidity vertical axis wind turbine at a moderate tip speed ratio. ***Energy***, 150, 236-252.

8. He, T., Zhang, H., & Zhang, K. (2018). A smoothed finite element approach for computational fluid dynamics: applications to incompressible flows and fluid–structure interaction. ***Computational Mechanics***, 62(5), 1037-1057.

2017

7. Ma, J., Zhou, D., Han, Z., Zhang, K., Nguyen, J., Lu, J., & Bao, Y. (2017). Numerical simulation of fluctuating wind effects on an offshore deck structure. ***Shock and Vibration***, 2017.

6. He, T., Zhang, K., & Wang, T. (2017). AC-CBS-based partitioned semi-implicit coupling algorithm for fluid-structure interaction using stabilized second-order pressure scheme. ***Communications in Computational Physics***, 21(5), 1449-1474.

5. Zhang, K., Katsuchi, H., Zhou, D., Yamada, H., Zhang, T., & Han, Z. (2017). Numerical simulation of vortex induced vibrations of a flexibly mounted wavy cylinder at subcritical Reynolds number. ***Ocean Engineering***, 133, 170-181.

4. He, T., & Zhang, K. (2017). An overview of the combined interface boundary condition method for fluid–structure interaction. ***Archives of Computational Methods in Engineering***, 24(4), 891-934.

Before 2016

3. Zhang, K., Katsuchi, H., Zhou, D., Yamada, H., & Han, Z. (2016). Numerical study on the effect of shape modification to the flow around circular cylinders. ***Journal of Wind Engineering and Industrial Aerodynamics***, 152, 23-40.

2. He, T., & Zhang, K. (2015). Combined interface boundary condition method for fluid–structure interaction: Some improvements and extensions. ***Ocean Engineering***, 109, 243-255.

1. Tu, J., Zhou, D., Bao, Y., Fang, C., Zhang, K., Li, C., & Han, Z. (2014). Flow-induced vibration on ita circular cylinder in planar shear flow. ***Computers & Fluids***, 105, 138-154.

Peer-Reviewed Conference Papers

7. Richardson, R., Eckert, B., Edstrand, A., Sun, Y., Schmid, P., Taira, K., and Cattafesta, L. N., *"Experimental Attenuation of a Trailing Vortex Inspired by Stability Analysis,"* 9th IUTAM Symposium on Laminar-Turbulent Transition, London, Sep. 2-6, 2019.
6. Sun, Y. and Hemati, M. S., *"Suppressing Subcritical Transition in Plane Poiseuille Flow,"* AIAA Aviation 2019 Forum, Dallas, TX, June 17-21, 2019 (AIAA paper 2019-3713).
5. Liu, Q., Sun, Y., Cattafesta, L. N., Ukeiley, L. S., and Taira, K., *"Resolvent Analysis of Compressible Flows over a Long Rectangular Cavity,"* 2018 AIAA Aerospace Sciences Meeting, Kissimmee, FL, Jan 8-12, 2018 (AIAA paper 2018-0588).
4. Yeh, C-A., Sun, Y., and Taira, K., *"Thermal-based Separation Control of Flow over an Airfoil and its Resolvent Analysis,"* Ninth JSME-KSME Thermal and Fluids Engineering Conference, Okinawa, Oct 28-30, 2017.
3. Sun, Y., Zhang, Y., George, B., Taira, K., Cattafesta, L. N. and Ukeiley, L. S., *"Width and Sidewall Effects on High-speed Cavity Flows,"* 54th AIAA Aerospace Sciences Meeting, San Diego, CA, Jan 4-8, 2016 (AIAA paper 2016-1343).
2. Zhang, Y., Sun, Y., Arora, N., Cattafesta, L. N., Taira, K., and Ukeiley, L. S., *"Suppression of Cavity Oscillations via Three-dimensional Steady Blowing,"* 45th AIAA Fluid Dynamics Conference, Dallas, TX, June 22-26, 2015 (AIAA paper 2015-3219).
1. Sun, Y., Nair, A. G., Taira, K., Cattafesta, L. N., Brès, G. A., and Ukeiley, L. S., *"Numerical Simulations of Subsonic and Transonic Open-cavity Flows,"* 7th AIAA Theoretical Fluid Mechanics Conference, Atlanta, GA, June 16-20, 2014 (AIAA paper 2014-3092).

Conference Presentations

(† invited)

22. (Upcoming) Seh, K., Gladson, S., King, J., Green, M., Fernandez, M., Ivany, L., and Sun, Y., *"Numerical Investigation of Flow over Orthoconic Structure,"* 74nd Annual Meeting of the APS Division of Fluid Dynamics, Phoenix, Nov. 21-23, 2021.
21. (Upcoming) Fernandez, M., Gladson, S., King, J., Seh, K., Sun, Y., Green, M., and Ivany, L., *"Preliminary Investigations into the Ecology and Functional Morphology of the Annulated Orthoconic Cephalopod Spyroceras,"* The Geological Society of America Connects 2021, Portland, Oct. 10 -13, 2021.
20. † Sun, Y., Liu, Q., Yeh, C-A., and Taira, K., *"Physics-Driven Control of Turbulent Cavity Flows using Stability and Resolvent Analyses,"* SIAM Conference on Computational Science and Engineering, Fort Worth, March 1- 5, 2021 .
19. † Mushtaq, T., Yao, H., Sun, Y., and Hemati, M. S., *"Sensor Selection for Performance Recovery: Controlling Transition to Turbulence in Shear Flows,"* SIAM Conference on Computational Science and Engineering, virtual, March 1-5, 2021.
18. Eckert, B., Zhang, Y., Edstrand A., Sun, Y., Schmid, P., Taira, K., and Cattafesta, L. *"Experimental Attenuation of a Trailing Vortex Inspired by Stability Analysis,"* , AIAA Aviation Forum and Exposition, virtual, June 15-19, 2020.
17. Sun, Y., Yao, H., and Hemati, M. S., *"Nonlinear performance of linear sensor-based output feedback control of transitional channel flow,"* 72nd Annual Meeting of the APS Division of Fluid Dynamics, Seattle, Nov. 23-26, 2019.
16. Yao, H., Sun, Y., and Hemati, M. S., *"Sensor selection for feedback control of transient energy growth in wall-bounded shear flows,"* 72nd Annual Meeting of the APS Division of Fluid Dynamics, Seattle, Nov. 23-26, 2019.

15. Liu, Q., Sun, Y., Yeh, C-A., and Taira, K., *"Supersonic cavity flow control using resolvent analysis,"* 72nd Annual Meeting of the APS Division of Fluid Dynamics, Seattle, Nov. 23-26, 2019.

14. Richardson, R., Eckert, B., Edstrand, A., Sun, Y., Schmid, P., Taira, K., and Cattafesta, L. N., *"Active attenuation of a trailing vortex inspired by a stability analysis,"* 9th IUTAM Symposium on Laminar-Turbulent Transition, London, Sep. 2-6, 2019.

13. Edstrand, A., Sun, Y., Schmid, P., Taira, K., and Cattafesta, L.N., *"Instability-based control of a trailing vortex,"* ONERA Lille & University of Lille, France, June 14, 2019.

12. † Sun, Y., Yao, H., Kalur, A., and Hemati, M. S., *"Feedback control of transitional channel flow via reduced-order modeling,"* AIAA AVIATION Forum 2019, Dallas, June 17-21, 2019.

11. Liu, Q., Sun, Y., and Taira, K., *"Unsteady control of a supersonic cavity flow using resolvent analysis,"* The 13th Southern California Flow Physics Symposium, Santa Barbara, April 20, 2019.

10. Edstrand, A. M., Sun, Y., Schmid, P. J., Taira, K., and Cattafesta, L. N., *"A parabolized stability analysis to design of a trailing vortex wake,"* 71th Annual Meeting of the APS Division of Fluid Dynamics, Atlanta, Nov. 18-20, 2018.

9. Sun, Y., Zhang, Y., Liu, Q., Singh, S., Cattafesta, L. N., Taira, K., and Ukeiley, L. S., *"Uncovering flow physics for high-speed cavity flow control,"* Department of Mechanical Engineering, University of New Mexico, October 5, 2018.

8. † Taira, K., Sun, Y., Yeh, C-A., Nair, A. G., and Liu, Q., *"Application of Modal Analysis to Active Flow Control,"* Flow Control Conference, AIAA Aviation Forum, Atlanta, GA, June 25-29, 2018.

7. Sun, Y., Liu, Q., Cattafesta, L. N., Ukeiley, L. S. and Taira, K., *"Use of biglobal stability and resolvent analyses for controlling cavity flows,"* 70th Annual Meeting of the APS Division of Fluid Dynamics, Denver, Nov. 19-21, 2017.

6. Yeh, C-A., Sun, Y. and Taira, K., *"Thermal-based separation control of flow over an airfoil and its resolvent analysis,"* Ninth JSME-KSME Thermal and Fluids Engineering Conference, Okinawa, Japan, Oct 27-30, 2017.

5. † Sun, Y., Taira, K., Cattafesta, L. N. and Ukeiley, L. S., *"Use of global stability analysis for active control of high-speed cavity flows,"* AIAA Aviation and Aeronautics Forum and Exposition (AIAA AVIATION 2017), Denver, CO, June 5-9, 2017.

4. Sun, Y., Taira, K., Cattafesta, L. N. and Ukeiley, L. S., *"Effects of spanwise instabilities on the suppression of wake mode in flow over a long rectangular cavity,"* 69th Annual Meeting of the APS Division of Fluid Dynamics, Portland, OR, Nov. 20-22, 2016.

3. Sun, Y., Taira, K., Cattafesta, L. N. and Ukeiley, L. S., *"Biglobal stability analysis of high-speed compressible open-cavity flows,"* 68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, MA, Nov. 22-24, 2015.

2. Sun, Y., Taira, K., Cattafesta, L. N. and Ukeiley, L. S., *"Biglobal stability analysis of high-speed cavity flows and its application to flow control,"* 6th Symposium on Global Flow Instability and Control Hersonissos, Heraklion, Crete, Greece, Sep. 28 - Oct. 2, 2015.

1. Sun, Y., Nair, A. G., Taira, K., Brès, G. A., Cattafesta, L. N. and Ukeiley, L. S., *"Stability Analysis of High-Speed Cavity Flow,"* 66th Annual Meeting of the APS Division of Fluid Dynamics, Pittsburg, PA, Nov. 24-26, 2013.