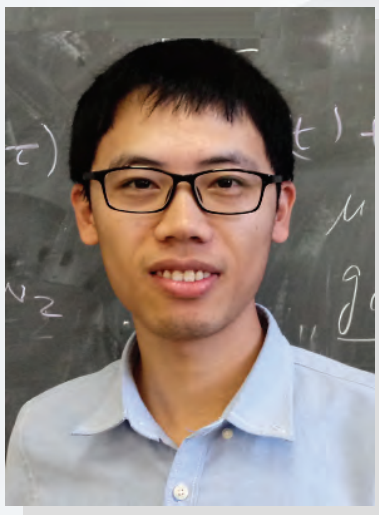
Department of Advanced Design and Systems Engineering
香港城市大學
City University of Hong Kong

Towards efficient analysis and optimal design of complex and high-dimensional nonlinear dynamical systems



3 Nov 2022 (Thu) | 4:00 pm

Seminar Link: https://cityu.zoom.us/j/92342183462

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Abstract

Efficient simulation has been a big challenge for complex and high-dimensional nonlinear dynamical systems that have been widely encountered in engineering. Such a simulation efficiency is essential for applications such as design, control, optimization, and uncertainty quantification that require repeated model evaluations on a potentially large parameter domain. In this talk, I will briefly present computational methods and platforms developed during my past and ongoing research to address the challenge. Applications of these computational methods and tools in aerospace engineering will be provided to demonstrate their effectiveness in addressing the challenge. Specifically, I will first present structure-preserving algorithms for optimal control of systems in complex operating environments with collision avoidance and path/control constraints. Then I will show a computational platform that supports automated generation of first-order necessary conditions of constrained optimization and initialization-free methods that solve for the necessary conditions. Finally, I will present an exact and rigorous nonlinear model reduction method for high-dimensional nonlinear finite element models. This model reduction enables efficient extraction of backbone and forced response curves, and prediction of bifurcations.

About the Speaker

Mingwu Li received the B.Eng. degree in engineering mechanics from the Huazhong University of Science and Technology, Wuhan, China, in 2013, the M.Eng. degree in computational mechanics from the Dalian University of Technology, Dalian, China, in 2016, and the Ph.D. degree in mechanical engineering from the University of Illinois at Urbana-Champaign, IL, USA, in 2020. He is currently a Postdoc in ETH Zurich, Switzerland. He performs research on dynamics control, including flow-induced vibrations, computational optimization and optimal control, complex systems, and nonlinear model reduction. He has published more than 20 peer-reviewed papers and (co-)developed 6 open-source toolboxes to facilitate the analysis and design of dynamical systems.

Enquiry: 3442 8422 | All are welcome