

Lecture by

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Fault Detection and Fault Tolerant Control of Complicated Dynamic Systems with Spacecraft Applications

With the widespread popularity of control system in human's various fields, the development of society is becoming more and more dependent on control system. The safety, reliability and effectiveness of system equipment has received extensive research attention. The appearances and development of fault detection (FD) and fault-tolerant control (FTC) methods have presented a novel way to ensure and improve the safety and reliability of the systems. In this presentation, the FD and FTC design problem is considered for dynamic systems in modern industrial systems, where network-induced phenomenon such as data communication delay, data packet dropout, signal quantization, etc, and some unexpected phenomenon including sensor/actuator faults, measurements noise, input/output disturbance, model nonlinearity are considered in a unified framework. Such a design problem is difficult and challenging, and traditional FD and FTC methods cannot be applied directly here. We will give a new systemic FD and FTC design approaches for complicated dynamic system to solve this design problem. The proposed FD methods includes network-based FD filtering method, descriptor sliding mode observer and extended unknown input observer techniques, etc. The proposed FTC methods include adaptive control based FTC strategy and sliding mode control based FTC strategy. Finally, some practical applications of the developed FD and FTC methods on spacecraft in orbit are introduced.



Ming Liu was born in Jilin Province, China, in 1981. He received a B.S. degree in Information and Computing Science in 2003, and a M.S. degree in Operational Research and Cybernetics in 2006, respectively, from the Northeastern University, Liaoning, China. He received a Ph.D. degree in Mathematics from the City University of Hong Kong in 2009. He joined Harbin Institute of Technology in 2010, where he is currently a Professor. His research interests include networked control systems, fault detection and fault tolerant control, and spacecraft design and control. Dr. Ming Liu was selected as the "New Century Excellent Talents in University" of the Ministry of Education of China in 2013 and the "Top-Notch Young Talents of Ten-Thousands Talents Program" in 2018.