

Ground Effect on the Flow Stability of the Ducted-Fan Propulsion System in Flying Car



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Abstract

As urban air traffic demand increases, flying cars are rapidly developing, with electric ducted-fans becoming the preferred propulsion system due to their efficiency, safety, and low noise levels. However, during near-ground operations such as vertical takeoff and landing of flying cars, ground effect cause dynamic thrust fluctuations in ducted-fan propulsion system, severely affecting the safety of near-ground flights. In response to this issue, our team has conducted research on the impact of ground effect on the flow stability of ducted-fan. Under near-ground conditions, ground effect would trigger rotating stall in the ducted-fan, and the rotating stall cells are the main cause of dynamic thrust fluctuations. Further, we proposed a meta-learning based ducted-fan ground effect model for the real-time thrust prediction, which would be benefit to guide the flight control to ensure the flight safety.

About the Speaker

Dr. Yuping Qian obtained his Ph. D. degree in Beihang University. He is the deputy director of Power Engineering Institute in School of Vehicle and Mobility, Tsinghua University, and the chief scientist in flying car development. His research interests include aerothermodynamics, focusing on high-power density new-energy turbine hybrid electric propulsion technology for aviation and flying cars. He was awarded the Wright Brothers Medal by SAE International in 2019, and the "Young Engineer Award" award by the Asian Fluid Machinery Committee (AFMC) in 2021. He is currently the deputy chairman of the youth committee of the "New Energy and Power Professional Committee" of the China Aerospace Power Association and a senior member of the Royal Aeronautical Society in the UK.