Energy-Harvesting Propellers

An Aerodynamic and Aeroacoustic Study

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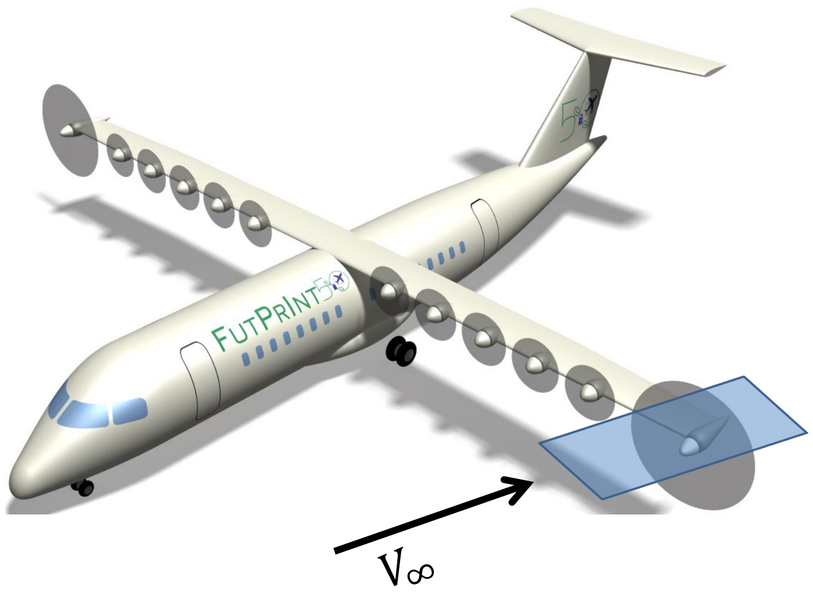
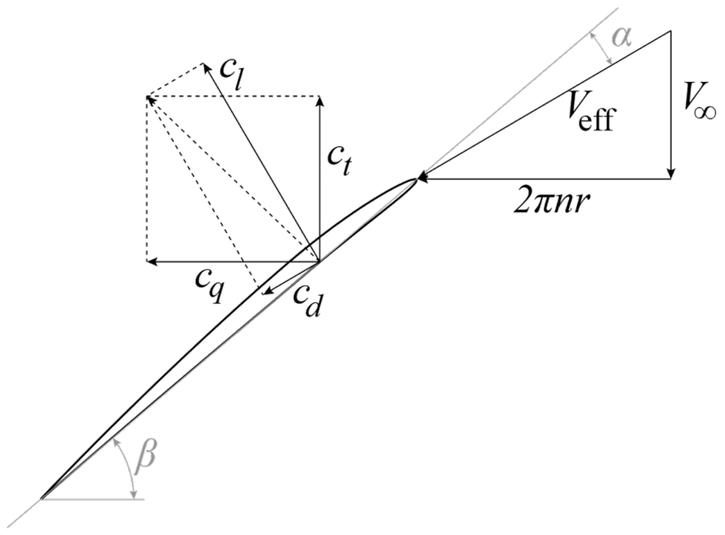
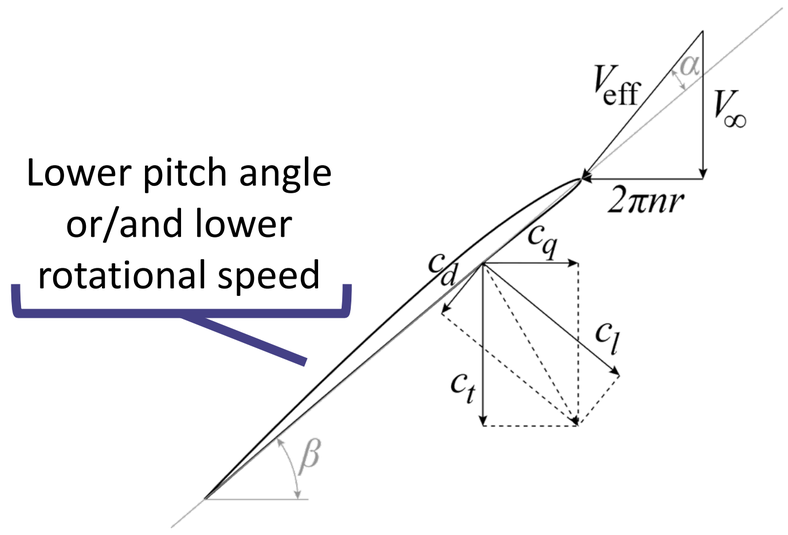
Outline:



Climb and Cruise (Propulsive)



Descent and Landing (Energy-harvesting)



Motivation:

Energy-harvesting propellers have potentially many benefits:

- reduced mission energy cost[1]
- reduced community noise[2]
- better manoeuvrability [3, 4]
- reduced landing run[3, 4]

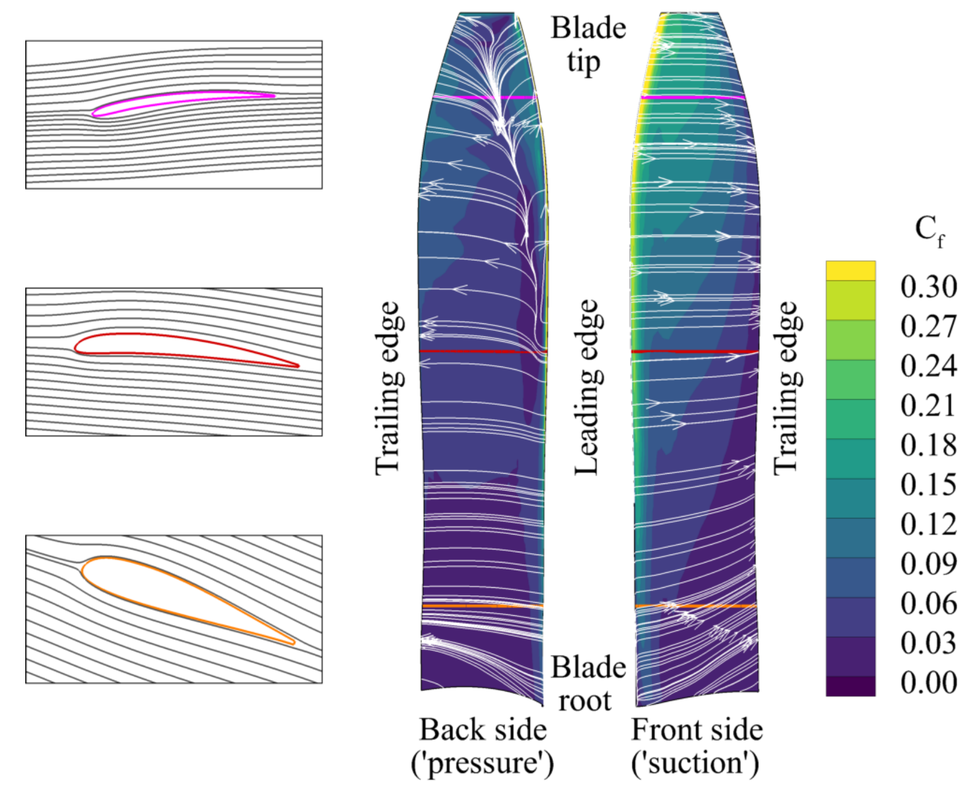
Objectives:

- To understand the changes in the aeroacoustic signature in a regenerative operation in comparison to the conventional propulsive mode which will impact landing noise
- To evaluate the capabilities of different numerical methods for prediction of regenerative regime phenomena to establish the required fidelity for studying aerodynamics and aeroacoustics

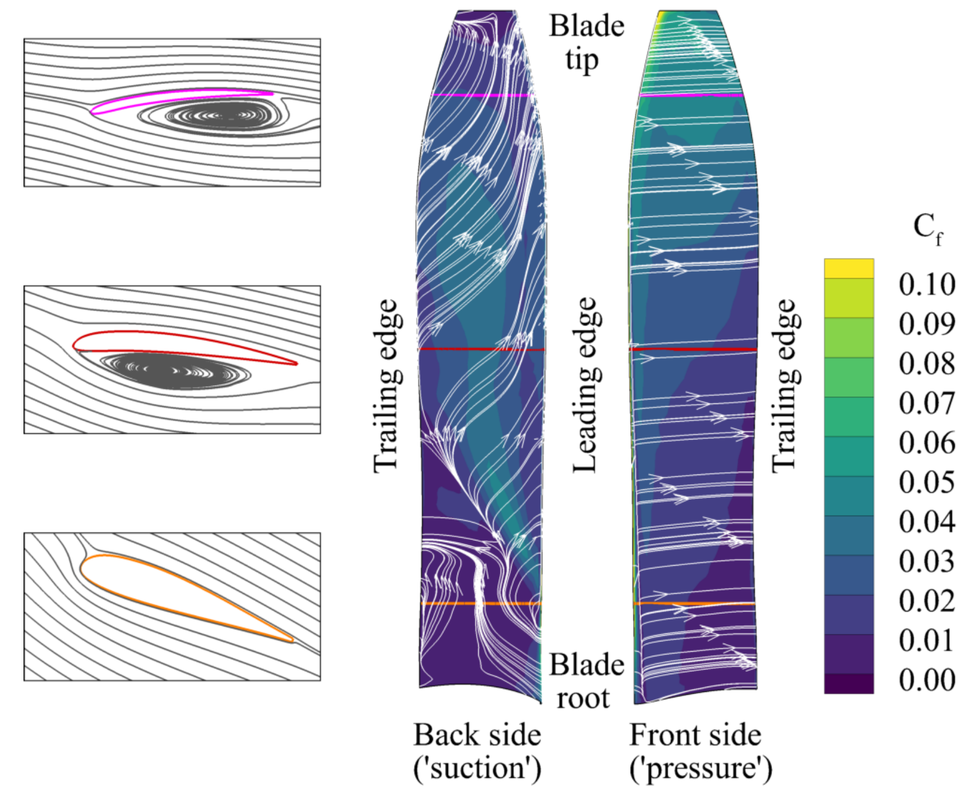
Societal relevance:

Exploring the applicability of energy-harvesting propellers as air brakes leading to potentially **safer and quieter landing operations** at a **lower mission cost** for future hybrid-electric or fully electric aircraft.

Results:



Climb and Cruise (Propulsive)



Descent and Landing (Energy-harvesting)

References:

[1] David Erzen et al. "An Optimal Propeller Design for In-Flight Power Recuperation on an Electric Aircraft." 2018 Aviation Technology, Integration, and Operations Conference. 2018.
[2] Jacqueline L. Thomas et al. "Community Noise Reduction Assessment of Using Windmilling Drag on Approach by Hybrid Electric Aircraft." AIAA Aviation Forum. 2020.
[3] Hartman, Edwin P. *Negative thrust and torque characteristics of an adjustable-pitch metal propeller*. US Government Printing Office, 1933.
[4] Douglass, William M. "An experimental investigation of the thrust and torque produced by propellers used as aerodynamic brakes." (1944).

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