SmartANSWER

Aerodynamic Noise Reduction by Porous Materials and Serrations

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Smart Mitigation of flow-induced Acoustic Radiation and Transmission for reduced Aircraft, surface traNSport, Workplaces and wind enERgy noise

Host institution: TU Delft

Secondment partner: SIEMENS Gamesa RENEWABLE ENERGY

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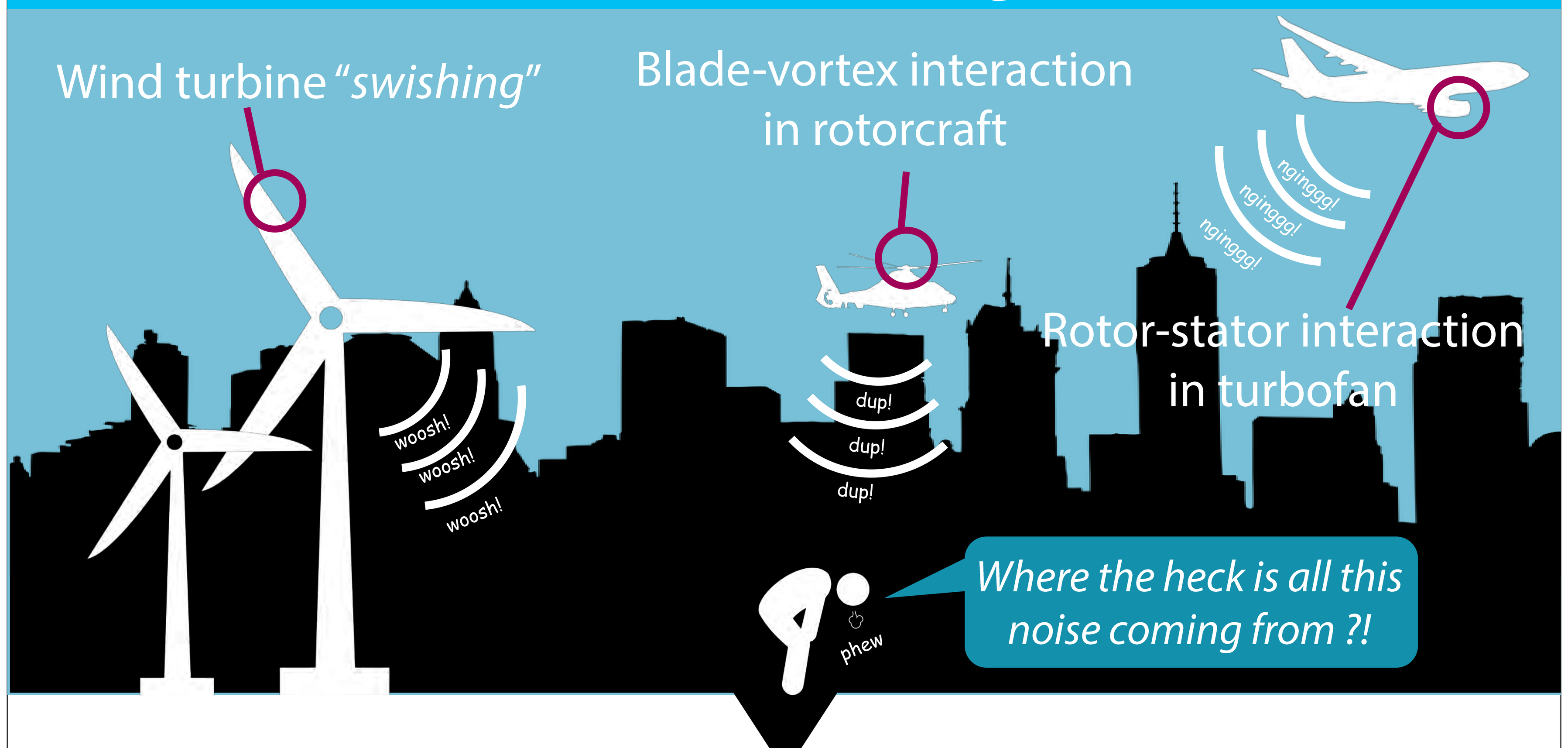
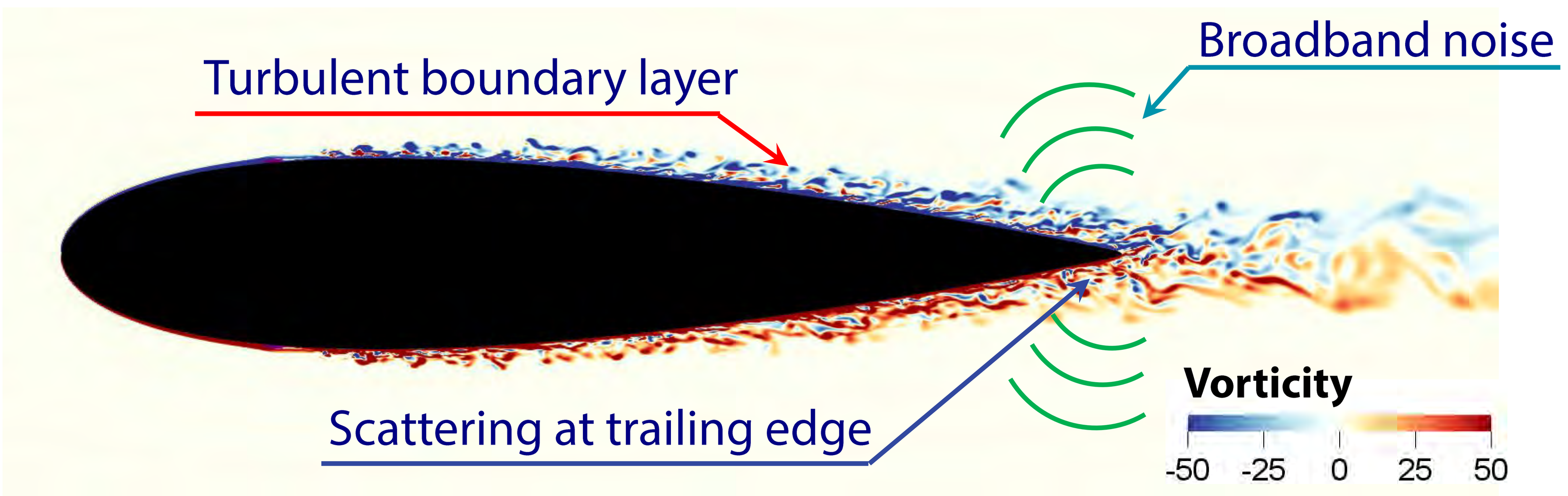
OUR FUTURE IS STILL QUITE NOISY

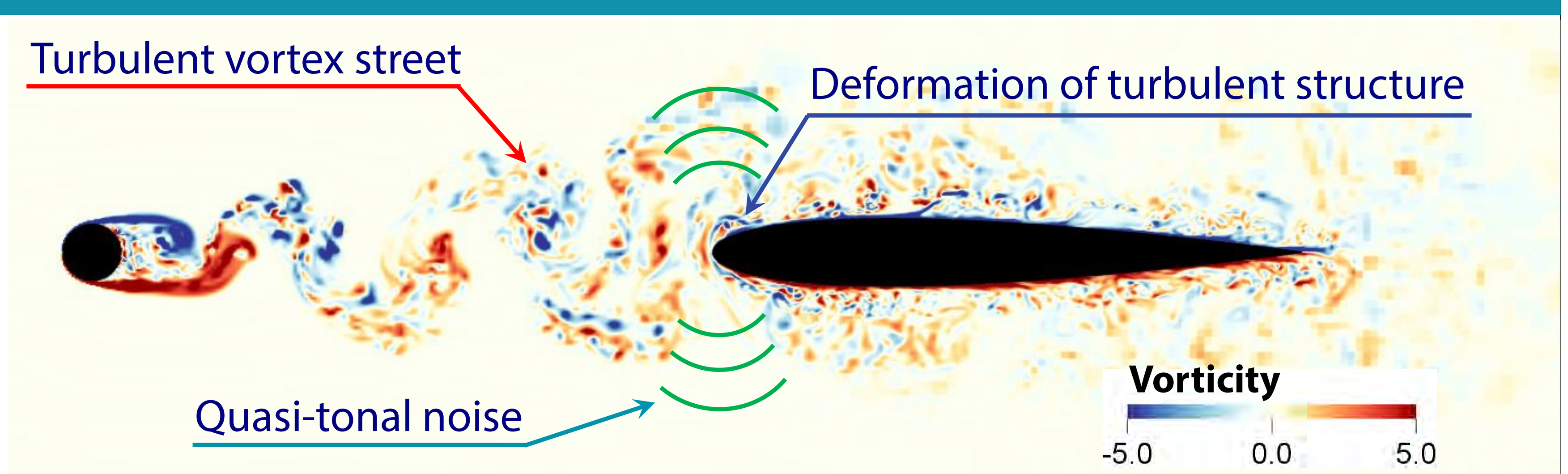


1. Turbulent Boundary Layer – Trailing Edge (TBL-TE) Noise



As pressure fluctuations inside a **turbulent boundary layer** encounter a sharp **trailing edge**, broadband noise is scattered. This mechanism is responsible for the *swishing* noise produced by **wind turbines** [1].

2. Wake – body Interaction Noise (Leading Edge Noise)

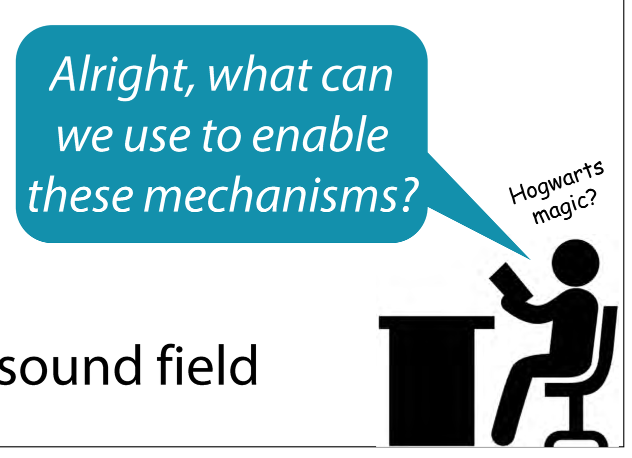


An aerodynamic body that encounters turbulent inflow would be subject to **fluctuating lift** concentrated around the **leading edge**. This is one of the main noise generation mechanisms in **helicopter rotors** and **aircraft turbofans** [2,3].

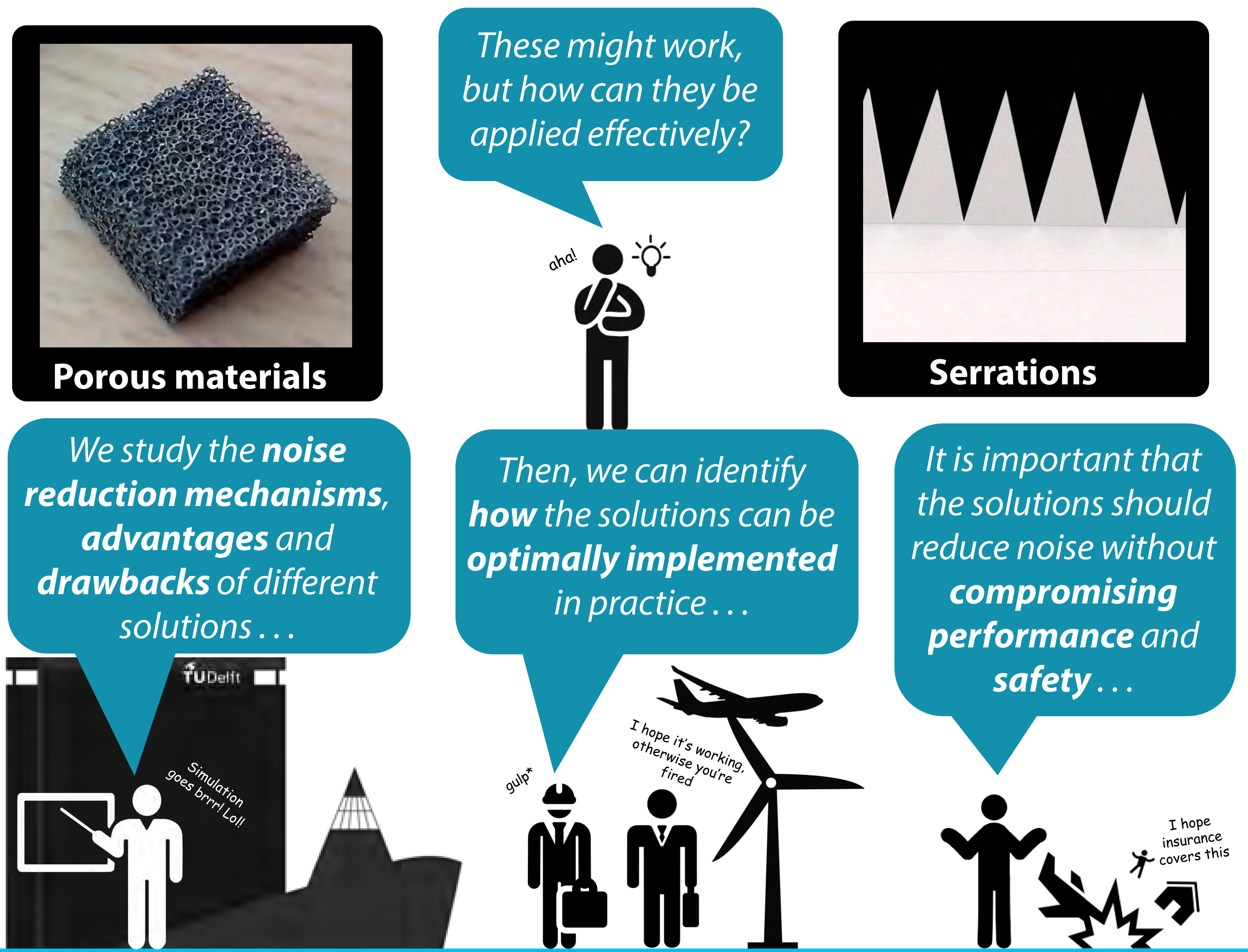
NOISE MITIGATION MECHANISMS

Possible means of noise mitigation:

1. **Decreasing** noise scattering **efficiency**
2. **Reducing** noise source **coherence**
3. **Altering** noise radiation **directivity**
4. **Promoting** destructive **interference** in the sound field

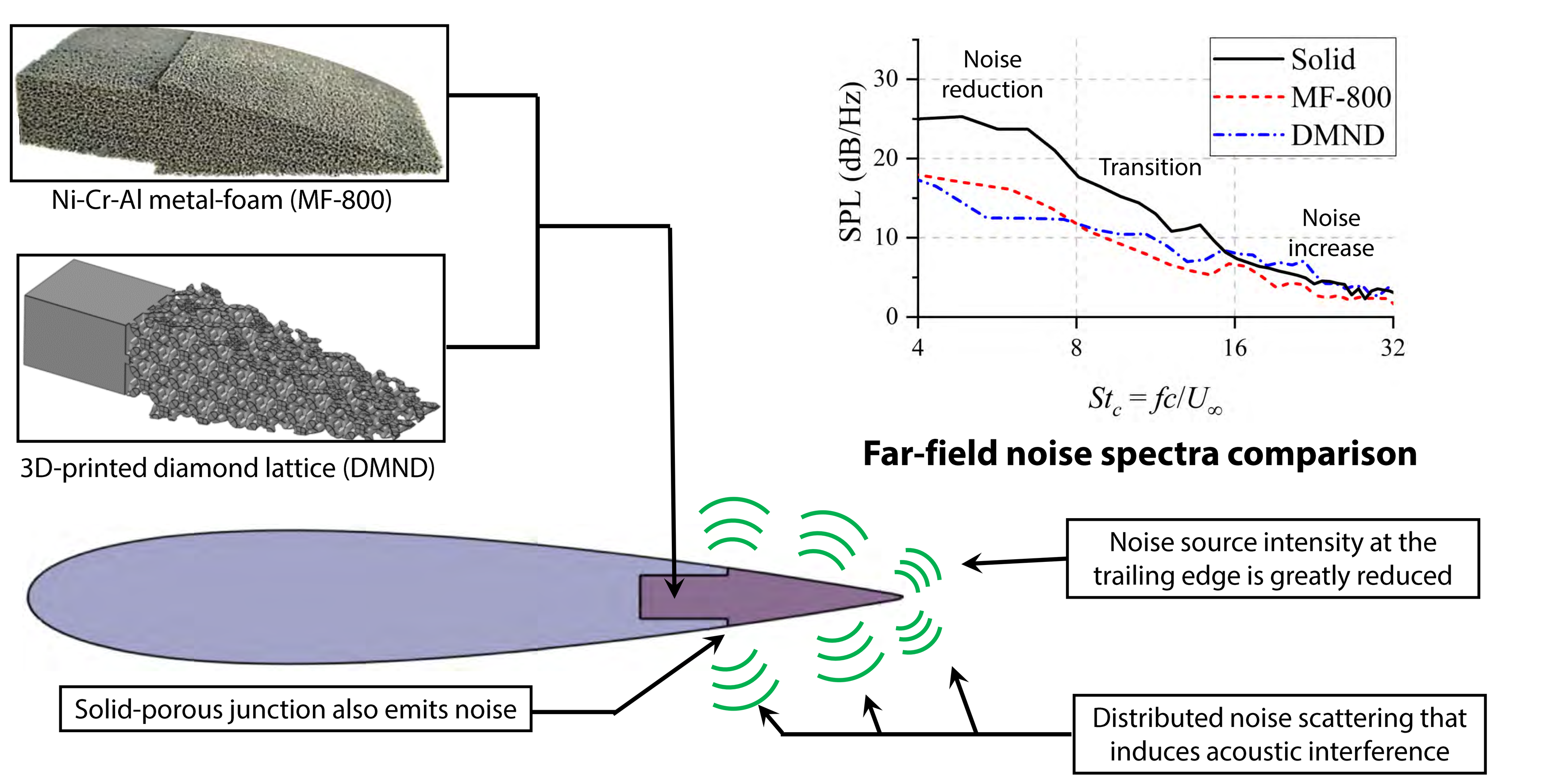


POTENTIAL SOLUTIONS



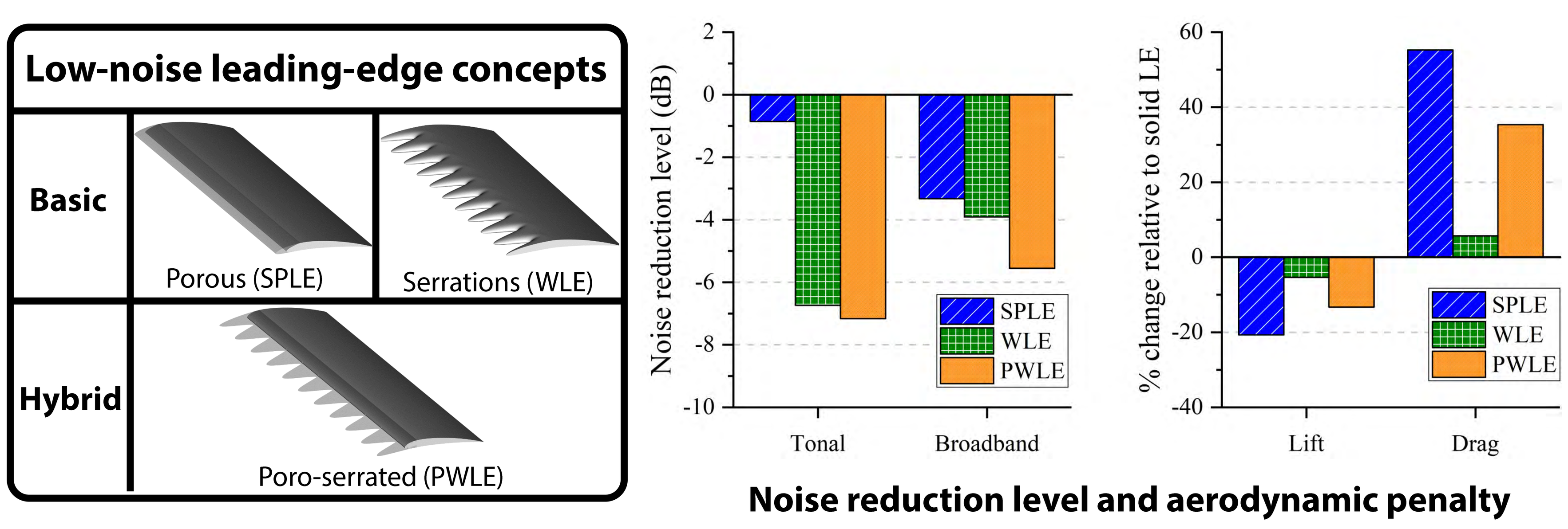
RESULTS AND CONCLUSIONS

(a) NACA 0018 with permeable trailing edge [4,5]

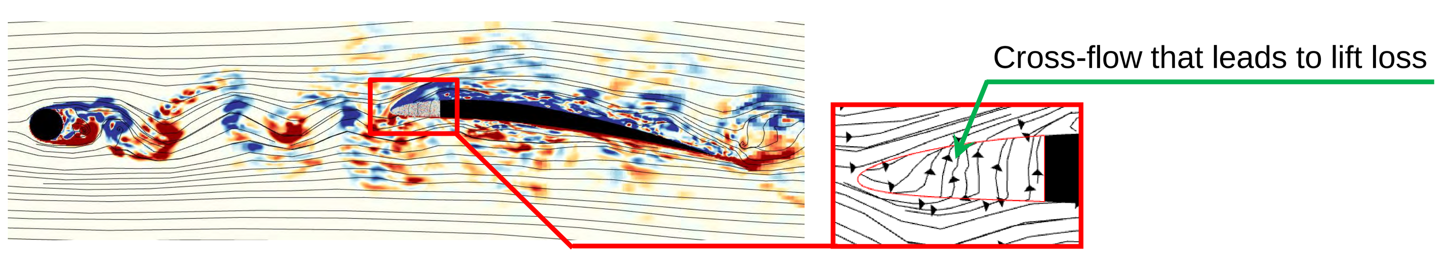


Porous insert attached to a NACA 0018

(b) Rod-NACA 5406 interaction noise [5,6]



Noise reduction level and aerodynamic penalty



The vorticity contour and streamlines of a rod-NACA 5406 configuration

The ***poro-serrated*** *LE* ***combines*** *two advantages; the* ***decreased*** *noise scattering efficiency of the* ***porous LE*** *and the* ***reduced*** *spanwise noise source coherence of the* ***serrations****.*

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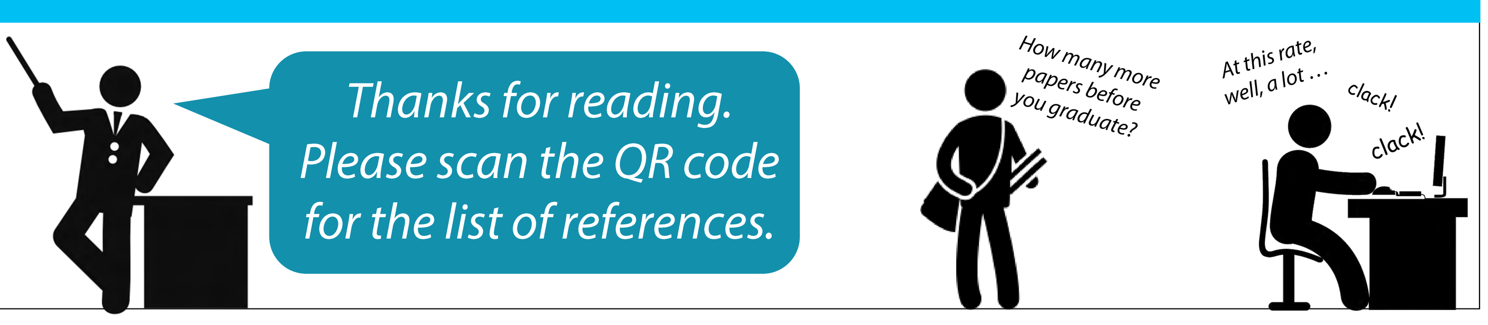
REFERENCES



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MARIE CURIE ACTIONS