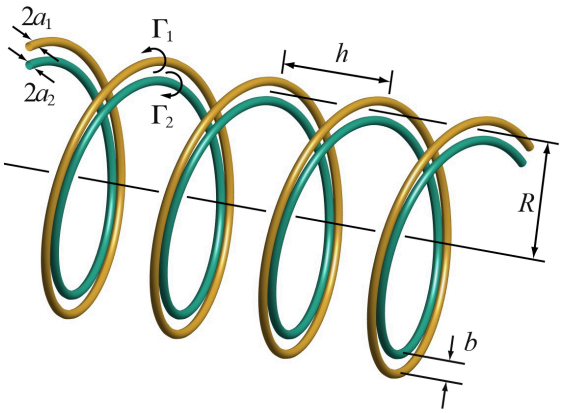
irphé
Institut de Recherche sur les Phénomènes Hors Equilibre

Post-Doc position

Structure and stability of helical vortex pairs

Type of work:	Theoretical and numerical
Affiliation:	Institut de Recherche sur les Phénomènes Hors Equilibre CNRS / Aix-Marseille Université / Centrale Marseille Marseille, France https://www.irphe.fr
Duration:	1 year (renewable once) start: January 2019 or earlier
Salary:	2500 €/month (gross)



Description

The project aims at investigating the characteristics and behaviour of helical vortex pairs, which is a topic in the field of fundamental fluid mechanics (vortex dynamics), related to practical applications involving rotors. Rotating blades, such as the ones of a helicopter main rotor or of a horizontal-axis wind turbine, generate concentrated vortices at their tips, which are then transported downstream, taking on a helical geometry. The present study is motivated by a particular concept useful for noise reduction, which consists in adopting a particular tip geometry leading to the formation of two distinct tip vortices instead of a single one. The resulting helical wake is formed of vortex pairs. The objectives of the work are the characterisation of the solutions that can be obtained in the far wake, and the analysis of their stability with respect to long- and short-wavelength instabilities.

Framework

This work will be performed within the team "Fluid Structure Elasticity" of IRPHE. It is funded by the French National Research Agency (ANR, contract TWIN-HELIX, PI: T. Leweke). The candidate will work under the guidance of Stéphane Le Dizès. He/she will collaborate with PhD student E. Durán-Venegas, who has developed the numerical code that will be used. He/she will also interact with T. Leweke and his students, who are performing related experimental work.

References

Leweke, T., Quaranta, H. U., Bolnot, H., Blanco-Rodriguez, F. J., Le Dizès, S., Long- and short-wave instabilities in helical vortices. *J. Phys.: Conf. Ser.* **524**, 012154 (2014).

Blanco-Rodríguez, F. J., Le Dizès, S., Curvature instability of a curved Batchelor vortex. *J. Fluid Mech.* **814**, 397-415 (2017).

Durán-Venegas, E., Le Dizès, S., Generalized helical vortex pairs. *J. Fluid Mech.* (submitted, preprint available on request).

Application

Solid knowledge in fluid dynamics and proficiency in numerical simulation are required. Competence in stability analysis and/or vortex dynamics will be appreciated.

Enquiries and applications (detailed CV + motivation letter) should be addressed to: Stéphane Le Dizès (ledizes@irphe.univ-mrs.fr; https://www.irphe.fr/~ledizes).