



Northeastern

PhD Position in Wind Engineering & Wind-based Energy Harvesting

Principal Investigator (PI): [Prof. Luca Caracoglia](#)

Institution: Northeastern University, Boston, USA

Project: Exploiting the Wind Energy Resource through Aeroelastic Vibration & Torsional Flutter

Sponsor: National Science Foundation, USA

Start date: September 1st, 2022 (Fall Semester 2022)

Duration: Three years of NSF-sponsored fellowship (+1 year with internal funds)

Project Summary

Wind energy is an important component of the United States program for renewable energy. As part of this effort, large-scale systems (onshore and offshore wind turbines) have been thoroughly investigated. On the opposite side of the “spectrum”, micro-scale wind energy has been examined for the purposes of deployment of small sensors that are self-sufficient and self-recharging. Both technologies have reached an advanced maturity. In contrast, the meso-scale range, i.e., the intermediate scale of a single-family household or a street block, is largely unexplored and has good potential for growth and innovation. This project addresses the need for clean energy at the meso-scale level, using a simple and compact wind-based energy harvester. The proposed power generator exploits the torsional aeroelastic instability (i.e., torsional flutter) of a blade-airfoil apparatus. The proposed technology will be viable since its operational mechanism is simpler than other, similar harvesting technologies proposed in the recent past.

The project will examine the technical feasibility of the apparatus (wind energy harvester) that exploits torsional flutter. Torsional flutter is a single mode aeroelastic instability phenomenon, which triggers a diverging vibration of a flexible body. The project will make use of preliminary results, in which a numerical model was employed to predict mechanical vibrations and induced currents. The investigation will include analytical, numerical and experimental stages. The objectives of this research are: 1) advancement of the current theory and analytical modeling of flutter energy “scavenging”; 2) assembly of a prototype unit used in the verification and validation studies in the laboratory; and 3) deployment of one unit at full scale. The first objective will consider the modeling of post-critical dynamics, nonlinear aeroelastic force and response, and the calibration of the key parameters of the proposed wind energy harvester. The second objective will be accomplished through the design of a reduced-scale unit, followed by validation in wind tunnel.

Information and Pre-Application Process

The PI is seeking for a motivated student who wishes to join the **PhD program** in Civil Engineering at Northeastern University to assist with research described above. *Qualifications of the applicant* are: a) MS degree (or equivalent diploma title) either completed or near completion by early 2022 in civil engineering, mechanical engineering or related field with a focus on wind engineering study, b) TOEFL (or IETLS) scores greater than 79 (or 6.5), and GRE exam scores.

Interested students are kindly requested to contact the PI directly by email at lucac@coe.neu.edu, prior to formal application via [Graduate School of Engineering](#). The message should include: 1) brief statement of purpose, 2) detailed curriculum vitae, 3) copy of academic transcripts, 5) example of peer-reviewed publications (if any), 6) names of one (or more) references.

Pre-application process deadline: available now by email at lucac@coe.neu.edu

Formal application deadline: December 15, 2021 for early consideration.

Application website: [Graduate Student Support Center](#)

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