

## Development of a piezoelectric device to harvest energy from a turbulent boundary layer

Turbulent boundary layers are characterized by large amplitude velocity fluctuations near the surface. These fluctuations generally translate into aerodynamic drag, and therefore fuel consumption of flight vehicles. On the other hand, it might also be possible to harvest energy from these fluctuations to generate electrical power. For example, energy harvesting could be used on an airplane wing to power dedicated sensors or electrical appliances without the need to route cables through the structure, thus saving weight.

The goal of this Masterarbeit is to research the existing literature on energy harvesting from fluid fluctuations and to develop a working prototype of piezoelectric device to be used in the wind tunnels of the Chair of Aerodynamics. We are looking for a student interested in such a multidisciplinary and practical subject and capable of working autonomously on the topic.

Interested applicants should contact Prof. Julien Weiss ([julien.weiss@tu-berlin.de](mailto:julien.weiss@tu-berlin.de))

Example: piezoelectric generator used in an unsteady shear layer [1]

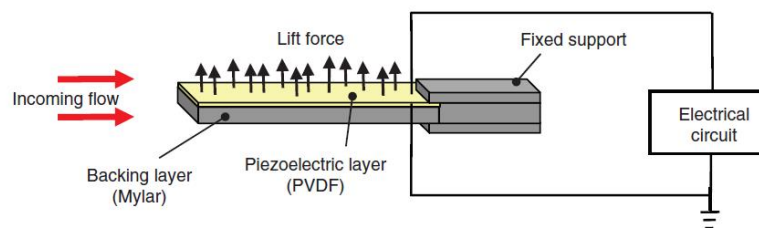


Figure 1. A schematic diagram of the piezoelectric generator in a flow field.

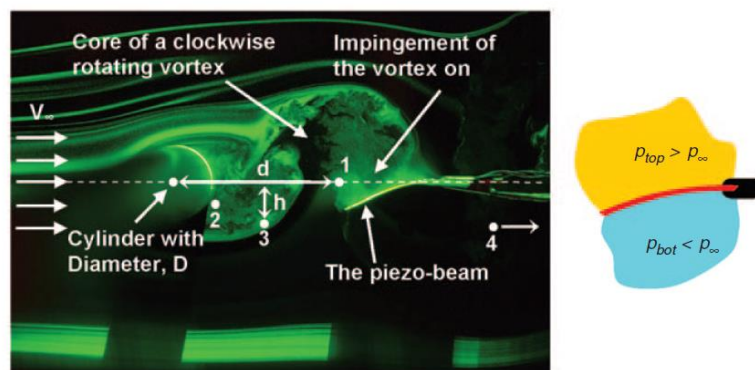


Figure 2. The concept of placing an elastic beam into the vortex street to induce vibration (smoke is used for flow visualization behind the circular cylinder). Designated points (1, 2, 3, and 4) represent approximate measurement locations. Background is a flow visualization picture obtained by the illumination of smoke particles released upstream with a laser sheet coming from the top of the figure. The black shadows on the bottom are cast by the cylinder and the beam.

[1] H.D. Akaydin, N. Elvin, and Y. Andreopoulos (2010) "Energy Harvesting from Highly Unsteady Fluid Flows using Piezoelectric Materials", *Journal of Intelligent Material Systems and Structures* 21(3), pp. 1263-1278