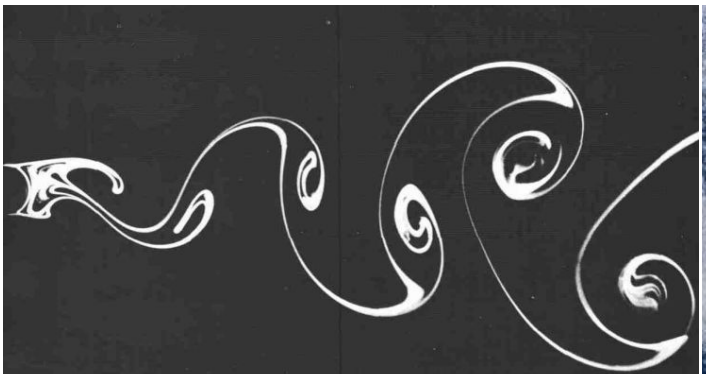
Semester project proposal:
Periodic forcing of the flow past a cylinder

The flow past a circular cylinder is characterized by a recirculating wake which becomes unstable when the Reynolds number gets larger than a critical value. It is the well-known "vortex shedding" or "von Kármán vortex street", observed downstream a variety of objects from small car antennas to large mountains or islands.



Von Kármán vortex street. **Left**: downstream a circular cylinder, Re=140 [Taneda]; **right**: downstream the volcanic island of Rishiri in Japan [NASA].

This project aims at investigating the effect of periodic forcing on this flow. by blowing and suction at the wall, which can be expected to lead to mean drag reduction, under some parameter choices. The objective of the project is to extend the numerical studies already performed in a linearized framework to fully non-linear simulations (using for example Comsol or FreeFem++ software). Specifically, it will be interesting to vary the Reynolds number, forcing frequency and forcing amplitude, and to analyze the time-dependent response to observe particular phenomena such as transient energy growth, competition between forcing frequency and natural frequency, effective drag reduction, etc.

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