

**Call for application for research scholarships
for post-graduate international candidates
RESEARCH PROJECT N. 16**

Title

Network-based approach to fluid flow systems

Scientific responsible (name, surname, role)

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Short description of the research activity (max 250 words)

The Research Project aims at applying the complex network theory to the turbulent flows dynamics, a subject of great fluid mechanical interest. By combining graph theory and statistical physics, complex networks provide a powerful tool to investigate the structure and function of complex systems with a large number of interacting elements. The versatility of complex networks [1] made their application suitable to analyze a wide range of phenomena from nature to economy, from engineering to society [2]. Beside these well-established applications, growing attention nowadays involves climate dynamics and fluid flows [3-5].

A network-based approach to the turbulence dynamics has strongly interdisciplinary features, and is proposed as an innovative and alternative path to the classical statistical analyses (e.g., energy spectra, two-point correlations, ...), which are commonly adopted to characterize turbulent fields. In fact, although turbulence is present in several natural phenomena (pollutant transport and atmospheric currents) and engineering applications (from aerodynamics to chemical reactors), and has been studied for decades, there are still important unsolved issues regarding its characterization, prediction and control.

Direct numerical simulations as well as laboratory experimental data will be processed, also in view of environmental fluid mechanics applications (e.g., boundary layer meteorology, air pollution, ...). The overall and main objective is to enrich and synthesize the spatial characterization and the basic knowledge of the physical mechanisms underlying the turbulence dynamics.

[1] Albert R et al., *Rev Mod Phys* 74: 47–97, 2002.

[2] Costa LD et al., *Adv Phys* 60: 329–412, 2011.

[3] Scarsoglio S et al., *PLoS ONE* 8 (8): e71129, 2013.

[4] Donner RV et al., *Chaos* 27: 035601, 2017.

[5] Scarsoglio S et al., *Int. J. Bifurcat. Chaos* 26: 1650223, 2016.

Specific requirements (experiences, skills)

Preferably:

- Good knowledge of programming languages (e.g., Matlab, Fortran, Mathematica, C, C ++, ...)
- Fundamentals of statistical physics and fluid mechanics
- Interest in interdisciplinary research approaches
- Basic knowledge of parallel computing techniques

Website of the research group (if any)

www.polito.it/fluidlab

Keywords (min 3, max 6)

Complex networks; Fluid Mechanics; Time-series analysis; Spatio-temporal patterns; Turbulent flows.

Research Area (max 1)

Mechanics and Aerospace

The present form should be filled in English and sent to scudo@polito.it by 2nd October 2017