Alessandro Stocchino

Professore associato

jorma@dicat.unige.it
+39 0103532432

Istruzione e formazione

1998
Master degree in Environmental Engineering
University of Genoa - Genova - IT

State certification Exam for the Professional Association of Engineers
Ordine Ingegneri della Provincia di Genova

2001
PhD in Hydraulic Engineering
University of Padua

Esperienza accademica

2001 - 2015
Assistant Professor in Fluid Mechanics
Department of Environmental Engineering - Genova - IT
Teaching and Research

2015 - IN CORSO
Associate Professor in Fluid Mechanics
Department of Civil Chemical and Environmental Engineering - Genova - IT
Teaching and research

Competenze linguistiche

English
Esperto

Interessi di ricerca

My background is primarily in applied fluid mechanics, turbulence and mass transport. I had a long training in mathematical modelling and laboratory techniques applied mainly in bio-fluid mechanics. My research interest can be summarized as follows:

· ***Mass transport and Mixing Processes***.

I have been interested in this topic since the beginning of my PhD and, in these years, I have studied these processes either theoretically and

experimentally. I have applied these concepts in several fields (environmental flows, bio-fluid mechanical applications such as the human eye and vascular diseases), which can be studied under common theoretical frameworks.
I am currently devoted to apply the most updated Lagrangian mixing measures (Finite time and Space Lyapunov exponents, Lagrangian Coherent Structures) in several geophysical context. Another hot topic of this line of research is the analysis of how micro-plastic is transported in marine environment. The pollution transport, including micro-plastic is the object of two European Interreg Projects that have been funded in these months.

· *Coastal and Estuarine circulation, Coastal Management*

Directly connected to the previous topic, in these last two years our group has established a strong collaboration with important national and international research centres that control the Mediterranean HF-Radar coastal network, with the aim to investigate coastal circulation and several environmental issues. Indeed, the HF-radar data have been used in order to evaluate the dispersion properties of the circulation. This topics are carried out in synergy with the Maritime Authorities with the future goal to develop prevention measures and rapid response tools against marine pollution. Coastal circulation studies are also carried out using open source numerical models widely used in this field (DELF-3D, ROMS).

· *River Hydro-Morphodynamics*

In several studies I have applied the stability linear and weakly non-linear theories with the aim to investigate the formation of small and meso-scale river bedforms (ripples, dunes and antidunes). As a research group, we have an internationally recognized expertise in river restoration and river morphodynamics. Besides, the theoretical studies, we have a deep knowledge of several numerical models commonly used for steady and unsteady flow simulations. The results have been collected in a series of scientific papers.

· *Flood risk Management*

1D and 2D numerical modelling is a powerful tools to be applied in river engineering in order to study the flooding risk and its mitigation measures. This line of research is the focus of one of the European project that started in 2017.

· *Bio-fluid mechanics.*

I have dedicated many years to the study of the human vitreous dynamics induced by eye movements and its relationship with several retinal diseases. I have been in charge mainly of the experimental activities of these researches. We based our works on the in-vitro experiments reproducing the vitreous chamber and its rotations with detailed physical models. We then applied the most sophisticated measuring techniques (Particle Image Velocimetry) to quantify the vitreous motion and its effects on the retina, mostly evaluating the mechanical stresses. Our group in collaboration with a surgical unit tested also the applicability of the Particle

Image Velocimetry in-vivo in order to characterise the status of the vitreous of the patient. In fact, we have analysed a series of ultrasound recordings with the same technique of the PIV, which in this case is known as US_PIV, and measure the velocities of the vitreous during controlled eye movements. This non-invasive technique is a promising method for a direct evaluation of several vitreous and retinal diseases.
Moreover, the laboratory activities aimed to investigate the drug delivery via direct injection within the vitreous chamber. Our group is internationally recognized as one of the main centre for the human vitreous dynamics studies. Recently, I coordinate a starting project on the fluid mechanical aspects of the vitrectomy, in particular, analysing the performance of different vitreous cutters and their possible effects on the retina. Most of the research has been developed in strict collaboration with ophthalmologists and retinal surgeons.
Moreover, in collaboration with the vascular unit of the main local hospital, we have conducted an interesting study on the biomechanical aspects of the aortic aneurysms. In particular, we have applied the same technique used within the vitreous chamber (US-PIV) with the aim to directly measure the hemodynamics within an AAA, evaluating the velocity fields and the mechanical stresses induced on the vessel wall and trying to use the information in for a future rupture risk analysis.

· *Laboratory techniques and Image analysis.*

Since most of my research is related to experimental modelling, I have a great insight into several measuring techniques. In particular:
Particle Image Velocimetry: non-invasive technique based on laser illumination and digital imaging to measure 2d and/or 3D velocity fields. This is a sophisticated technique for laboratory measuring.
Ultrasound-Particle Image Velocimetry: digital cameras are substitute by the use of Ultrasound scanners. This technique can be successfully applied to patients.
Doppler Velocimetry: this technique is based on acoustic Doppler profiling and it is often employed in fluid mechanics and or solid mechanics;
Pressure and flow measurements: I have a great experience in using pressure transducers and flow meter based on different technologies (piezoresistive transducers, electromagnetic/ultrasound/Coriolis forces flow meters).
Image analysis: Velocity measurements often are based on image analysis that involves image segmentation, features tracking, image cross-correlation