Allegato 1

Scheda di partecipazione per l'assegnazione di fondi per Progetti di Ricerca sviluppati da singoli Ricercatori – Anno 2021

TITOLO DELLA RICERCA	Image-based river velocity estimation: exploring optimal experimental setup for LS-PIV analyses in turbulent flows

PAROLE CHIAVE	
1	Particle Image Velocimetry
2	River Monitoring
3	Synthetic Image Sequence
4	PIV for Turbulent flows

PROPONENTE

COGNOME E NOME	PUMO DARIO
RUOLO	RTDa
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SSD	ICAR/02

EVENTUALI COLLABORAZIONI

N.	COGNOME E NOME	RUOLO	SSD o UNIVERSITA'/ORGANIZZ. ESTERNA
1	ALONGI Francesco	Dottorando	ICAR/02 (UNIPA)

SCOPO, DESCRIZIONE E RISULTATI ATTESI DELLA RICERCA

Stato dell'arte:

Optical based techniques (e.g., LS-PIV and LS-PTV), offer a great potential for river monitoring allowing for massive and low-cost real-time acquisitions at any flow conditions. Such techniques are rapidly evolving also in consideration of the increasing availability of a new generation of digital cameras. Using LS-PIV, the surface velocity field is indirectly obtained by analyzing acquired frame sequences and measuring the velocity of floating tracer particles, naturally present or artificially introduced to the flow, which is assumed to move with the local flow velocity. These techniques are still rarely systematically implemented in practical applications, probably due to the lack of consistent operational protocols. Numerical simulation represents a valid option to produce test-cases (with known velocity) and explore optimal experimental setup for LSPIV analyses in real cases.

Obiettivi, ipotesi e metodologia:

Recent works on LS-PIV analysis adopted numerical simulations to reproduce realistic configurations of randomly distributed tracers on a uniform flux (Dal Sasso et al., 2018). Numerical simulations under controlled conditions allows conducting sensitivity analyses on specific factors of interest (i.e. tracer size, density and distribution), minimizing the effects of external disturbances. The objective of the proposed work is to explore LS-PIV performance, also including the effects of turbulence, which could imply tracer spatial aggregation and deformation that were scarcely investigated in the past. The proposed methodology includes an ensemble-based approach, by which several possible scenarios will be generated and analyzed. Numerical simulations will be carried out through the module Fluent of the software ANSYS, generating controlled conditions affected by turbulence in a virtual channel with rectangular cross-section. LS-PIV analyses will be performed using the software programs PIVlab and FUDAA-LSPIV. Results will be validated in real cases by ad hoc field campaigns.

Risultati attesi:

The numerical simulations will produce important insights for the experimental setup in real cases, providing useful suggestions for an appropriate parameterization in terms of tracer concentration, frame-rate and duration of the video-sequence. Our experimental design, able to emulate turbulence, will be tested in a real case through ad hoc field campaigns and will be object of a research article that will provide an important contribution for river monitoring.

Caratteristiche di interdisciplinarietà del progetto:

The project will be developed through a synergistic approach including key topics from different SSDs. The river monitoring is a central theme of hydrology and the numerical simulations requires the use of hydraulic model in order to account for the effects of turbulence (ICAR/01; ICAR/02). The application of optical techniques requires competences on the acquisition/processing of image sequences (ICAR/06).

PUBBLICAZIONI PREVISTE (art. 6 del Regolamento)

One research paper in a Q1 International Scientific Journal indexed by ISI and Web of Science (e.g. ADVANCES IN WATER RESOURCES – ELSEVIER -IF:4.016, Subject Area and Category: Environmental Science, Water Science and Technology – Quartile: Q1)

FINANZIAMENTO RICHIESTO (max 1.700,00 €)	1.500,00

DESCRIZIONE DELLE SPESE PREVISTE

- 1000 euro per **spese di missioni**: al fine di effettuare da tre a cinque campagne di misure presso la stazione idrometrica Platani a Passofonduto (Campofranco – CL), per acquisizione sequenze video in alvei reali, con uso di tracciante naturale e simultanee misure di portata con ADCP (già in dotazione al gruppo di ricerca), al fine di validare i risultati ottenuti numericamente.
- 500 euro per **acquisto di materiali e attrezzature** (es., tracciante necessario per le misure, pile stilo alkaline per ADCP, ecc.)

Il sottoscritto, proponente del progetto, dichiara:

– di non avere disponibilità di fondi di ricerca per un importo superiore a 5.000 €;

Luogo e data Palermo, 11/10/2021

Firma

F.to Dario Pumo