Curriculum Vitae

Personal Information

Surname and name	Vesipa Riccardo
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Synthesis of research, applied research and consulting activities

My field of expertise is the modeling of processes related with the motion of fluids. I work with theoretical and numerical models. A significant part of my work involves physical modeling in flume facilities, pilot plants and downscaled real infrastructures.
My modeling activities consider three main aspects of the academic research. The first aspect is base research. Models are developed or applied to understand environmental processes induced by fluid-related mechanisms. The second aspect is applied research. Models are adopted to make use of well known fluid mechanic processes in the development of innovative industrial or environmental practical applications. The third and last aspect is consulting. Widely adopted and validated models are applied to real-world problems raised by private/public companies.
Since the beginning of my academic career, I work in the fields of morphodynamics (see publications [1,2,3,4,7,9,10] in the list of the complete scientific production), riparian vegetation dynamics (see [5,6,11]), water distribution networks (see [12]), biological systems ([8]).
More recently, I have started working on the use of hydrodynamic cavitation for water treatment, on the interactions between flow transient in pressurized conduits and control algorithms in hydropower systems (see [13,14]) and on the hydraulic behavior of urban areas subject to floods.
I have also worked in tight collaboration with industries to solve issues related with wind gusts, pressurized vapor distribution, sprinkler systems, and the response of industrial pressurized plants to seismic loads.

Education

Activity: **PhD Education**. *Period:* January 2010-December 2012. *University:* Politecnico di Torino, DITIC, Department of Hydraulics, Transport and Civil Infrastructures. *Thesis:* "River antidunes and bars: new models and nonmodal analysis". *Date of achievement:* 20/03/2013. *Advisors:* Prof. Carlo Camporeale and Prof. Luca Ridolfi.	• Theoretical and experimental description of the transient dynamics of alternate bars (see publication [1] in the list of the complete scientific production). • Development of a new model for the description of river antidunes (see publication [2] in the list of the complete scientific production). • Design and implementation of technical upgrades in an experimental flume with erodible bottom for the study of river morphodynamics. • Innovative procedures and instruments for topographic and bathymetric surveys in river morphodynamics flume experiments (see publication [10] in the list of the complete scientific production). • Physical modeling of braided rivers. • Influence of vegetation and flood events in the morphological response of rivers.

International education

Activity: visitor at Duke University. *Period:* March-May 2012. *University:* **Duke University**, Durham (USA), Department of Civil and Environmental Engineering. *Hosts:* Prof. Amilcare Porporato and Prof. Tom Witelski.	"Modeling of free surface flows''. The activity carried out has been functional to the development of a new model for the description of fluvial antidunes (see publication [2] in the list of the complete scientific production).
Activity: visitor at École Polytechnique. *Period:* March - April 2013. *University:* **École Polytechnique**, Paris (France), Laboratoire d'Hydrodynamique de l'X (LadHyX). *Host:* Prof. Jean Marc Chomaz.	"Study of the convective-absolute nature of the river bedform instabilities''. The convective nature of dunes and convective / absolute nature of river antidunes was mathematically demonstrated. The findings were validated with flume and numerical experiments reported in the literature (see publication [3] in the list of the complete scientific production).

Academic positions

Position: **Research fellow** (Assegnista di ricerca according to the Italian law 240/2010). *Period:* 16/01/2013 - 15/01/2014 (1 year). *University:* Politecnico di Torino, DIATI, Department of Environment, Land and Infrastructure Engineering.	"Evaluation of the impact of water diversions for energy production''. • Drafting of a technical document to be used for the assessment of the impacts produced by water diversions for energy use in mountain streams. • The main users of the technical document are (i) the technical office of the Piedmont Region that release authorizations of these plants, and (ii) engineers that design these plants. • The main aim of the document is to provide a common framework to the technical office of the Piedmont Region and to engineers for the administrative and environmental authorizations of water diversions.
Position: **Research fellow** (Contract in accordance with the Italian law 240/2010). *Period*: 16/01/2014 - 15/06/2014 (6 months). *University:* Politecnico di Torino, DIATI, Department of Environment, Land and Infrastructure Engineering.	"Analytical methods for the study of fluvial and karst morphodynamics''. A model was developed for the study of "crenulations", karst formations important for palaeo-climatic studies (see publication [4] in the list of the complete scientific production).
Position: **Research fellow** (Assegnista di ricerca according to the Italian law 240/2010). *Period*: 16/06/2014 - 15/06/2017 (3 years). *University:* Politecnico di Torino, DIATI, Department of Environment, Land and Infrastructure Engineering.	"Aqueduct and urban drainage networks''. • Analysis of the "Acquedotto della Valle di Susa'', a new hydraulic infrastructure for water distribution in the Susa valley. • Development of a numerical code for the network modeling and analysis. • Design of the system for the automatic regulation of the flow and of the tank levels. • Study of the functionality of the infrastructure in case of consumption peaks, production downs, conduit breakdowns, and maintenance activities. • Reduction of criticalities in the event of breakdowns. • Design of the system of energy recovery from overpressure dissipation. • Study of the flow transients occurring in the system.

Position: **Research fellow** (Contract in accordance with the Italian law 240/2010). *Period*: 16/06/2017 - 15/01/2018 (7 months). *University:* Politecnico di Torino, DIATI, Department of Environment, Land and Infrastructure Engineering.	"Space-time dynamics of pressure and flow waves in the human arterial tree". Study of simplified formulations for the estimation of arterial pressure at the aortic level by peripheral pressure measurements.
Position: **Researcher** (RTD-A in accordance with the Italian law 240/2010). *Period*: since 16/02/2018. *University:* Politecnico di Torino, DIATI, Department of Environment, Land and Infrastructure Engineering.	• Numerical modeling of river hydraulics, water quality, and morphodynamic processes with the software Delft3D and Basement. • Flume experiments about the hydraulic properties of urban streets. • Flume experiments about the dynamics of braided rivers. • Use of hydrodynamic cavitation as a mean of processes intensification, water potabilization, waste water treatment. • Numerical modeling of water distribution networks. • Numerical modeling of flow transients in pressurized pipes, with focus on stability issues arising in level based control schemes and leakage detection. • Numerical modeling of the stochastic dynamics of riparian vegetation.

Awards for research activities

Award: **Gii Special Mention for Doctoral Thesis in Water Engineering**.
Awarding institution: **Gii**, Gruppo Italiano di Idraulica.
Date of achievement: 01/07/2013.

Involvement in research or consulting projects

Type of project: Italian project "PRIN". *Period*: January 2010 – December 2012. *Name of the project*: "Interaction processes between fluvial morphodynamics and riparian vegetation dynamics". *Granting institution*: **MIUR**. *PI*: Prof. Luca Ridolfi. *Role*: collaborator.	• Study of the geo-morphological evolution of riparian transects in the presence of vegetation and stochastic variability of flow rates (see publication [5] in the list of the complete scientific production). • Study of the recovery time of riparian vegetation after destructive floods(see publication [6] in the list of the complete scientific production). • Study of the age of riparian vegetation patches forced by floods with random duration, frequency and intensity. • Study of the effect of hydrological changes of anthropic origin (dams, derivations, regulations) and natural origin (climate change) on the geo-morphological evolution of riparian transects, and on the recovery time of vegetation (see publications [5,6,11] in the list of the complete scientific production).
Type of project: European project. *Period*: January – December 2013. *Name of the project*: "Technical criteria for the assessment of the impacts of water diversions on the environmental components in mountain streams".	• Drafting of a technical document to be used for the assessment of the impacts produced by water diversions for energy use in mountain streams (see publication [22] in the list of the complete scientific production). • The main users of the technical document are (i) the

Granting institution: **European Union**. *PI*: Prof. Luca Ridolfi. *Role*: collaborator.	technical office of the Piedmont Region that release authorizations of these plants, and (ii) engineers that design these plants. • The main aim of the document is to provide a common framework to the technical office of the Piedmont Region and to engineers for the administrative and environmental authorizations of water diversions.
Type of project: European project. *Period*: April 2014 - June 2015. *Name of the project*: "WATSAM" International cooperation project granted by the European Union and aimed at developing the sustainable management of water sanitation and water potabilization in the Arba Minch town, Ethiopia. *Granting institution*: **European Union**. *PI*: Prof. Roberto Revelli and HydroAid. *Role*: collaborator.	• Course (in English) "Integrated Urban Water Management'' held in the city of Arba Minch (Ethiopia) in May 2014 (total duration of the course 80 hours). • Course (in English) "Training on GIS / GPS systems, hydraulic modeling and planning'' held at the Politecnico di Torino in September 2014 (total duration of the course 160 hours). • Numerical model of the water distribution network of the city of Arba Minch, Ethiopia (February-May 2015). • Mission of capacity building on the numerical modeling of drinking water distribution network for the local water company held in the city of Arba Minch (Ethiopia) in June 2015.
Type of project: Applied research. *Period*: July 2014 - July 2015. *Name of the project*: IoTibevo. *Granting institution*: European Union. *PI*: Luca Ridolfi and Prof. Fulvio Boano. *Role*: collaborator.	• Coupled Chemical-Hydraulic model of a city near Turin for the analysis of the chlorine dynamics in pipes. • Quantitative forecast of the chlorine concentration in the network areas not covered by monitoring.
Type of project: Consulting. *Period*: April 2014 - April 2017. *Name of the project*: Analysis of the functionality, management, and risk reduction of the "Valle di Susa Aqueduct'', a new hydraulic infrastructure for water distribution in the Susa Valley. *Granting institution*: **SMAT S.p.a** (Società Metropolitana Acque Torino). *PI*: Luca Ridolfi and Prof. Fulvio Boano. *Role*: collaborator.	• Analysis of the "Acquedotto della Valle di Susa'', a new hydraulic infrastructure for water distribution in the Susa valley (see publication [12] in the list of the complete scientific production). • Development of a numerical code for the network modeling and analysis. • Design of the system for the automatic regulation of the flow and of the tank levels. • Study of the functionality of the infrastructure in case of consumption peaks, production downs, conduit breakdowns, and maintenance activities. • Reduction of criticalities in the event of breakdowns. • Design of the system of energy recovery from overpressure dissipation. • Study of the flow transients occurring in the system.
Type of project: Applied research. *Period*: November 2015 – November 2017. *Name of the project*: Development of innovative water treatment techniques through the use of hydrodynamic cavitation. *Granting institution*: **SMAT S.p.a** (Società Metropolitana Acque Torino). *PI*: Prof. Luca Ridolfi and Prof. Costantino Manes. *Role*: collaborator.	• Preliminary exploration of the use of hydrodynamic cavitation as a physical method of water disinfection • Design and construction of a prototype for the disinfection of water through cavitation. • Preliminary testing of hydrodynamic cavitation for the degradation of organic pollutants. • Preliminary testing of hydrodynamic cavitation for the degradation of biological pollutants.
Type of project: Consulting. *Period*: January 2017 – July 2017 *Name of the project*: Physical model of the emergency	• Design and construction of a 1:40 scale model of the dam and spillway. • Measurements on the scale model to verify the real

spillway of the Gurzia dam (TO). *Granting institution*: **Enel S.p.a.** *PI*: Prof. Davide Poggi. *Role*: collaborator.	discharge capacity of the spillway.
Type of project: Consulting. *Period*: April 2018 – April 2019. *Name of the project*: Detection of water leakages by the analysis of flow transients in the "Valle di Susa Aqueduct". *Granting institution*: **SMAT S.p.a** (Società Metropolitana Acque Torino). *PI*: Prof. Luca Ridolfi and Prof. Fulvio Boano. *Role*: collaborator.	• Analysis of the "Acquedotto della Valle di Susa'', a new hydraulic infrastructure for water distribution in the Susa valley. • Implementation of a system to detect water leakages along the conduit by the analysis of local pressure time series.
Type of project: Applied research. *Period*: November 2015 – November 2017. *Name of the project*: Bubbles for life. *Granting institution*: Politecnico di Torino and **SMAT S.p.a** (Società Metropolitana Acque Torino). *PI*: Prof Costantino Manes. *Role*: collaborator.	• Optimization of the use of hydrodynamic cavitation as a physical method of water disinfection • Design and construction of a prototype for the disinfection of water through hydrodynamic cavitation in developing countries. • Detailed testing and optimization of hydrodynamic cavitation for potabilization purposes.
Type of project: Starting grant. *Period*: February 2018 – February 2021. *Name of the project*: Hydraulics of urban streets. *Granting institution*: Politecnico di Torino. *Role*: PI. *Budget*: 15 000 €.	• Physical modeling (at the lab scale) of the hydraulic behaviour of urban streets. • The capacity of conveying water flow, sediment flow, wood debris, and floating vehicles is evaluated. • Free parameters are the street aspect ratio, the occurrence of street furniture (e.g., trees, fences, benches), the possible occurrence of parked veichles. • The water depth under different roughness conditions is also evaluated.

Design and development of instruments, plants, and infrastructures

Reference project: "Interaction processes between fluvial morphodynamics and riparian vegetation dynamics''.	• Design and implementation of the computer numerical control (CNC) system for the management of the solid and liquid discharges in an experimental flume. • Design and implementation of the computer numerically controlled (CNC) sonar-laser system for the acquisition of topography and bathymetry of morphologies observed in an experimental flume with erodible bottom.
Reference project: "Analysis of the functionality, management, and risk reduction of the "Valle di Susa Aqueduct", a new hydraulic infrastructure for water distribution in the Susa Valley''.	• Design of the algorithms for the automatic regulation of the tank levels and for the flow distribution in the system. • Design of the system for energy recovery from overpressures dissipation. • Evaluation of the overpressure and of the flow transients in the conduits induced by adjustments and closures of valves.
Reference project: "WATSAM''.	• Assessment of the behavior (through numerical modeling) of the drinking water distribution network of the city of Arba Minch (Ethiopia).

Reference project: "Development of innovative water treatment techniques through the use of hydrodynamic cavitation".	• Design of the hydraulic, mechanical and electrical equipment for the preliminary testing and for the measurement of hydraulic, energy and chemical/biological treatment performances of innovative cavitation reactors.
Reference project: "Bubbles for life"	• Design of the hydraulic, mechanical and electrical equipment for the advanced testing, measurement, and optimization of the biological treatment performance of innovative cavitation reactors. • Design of an innovative cavitation reactor for water potabilization in developing countries.
Freelance engineering activities	• Hydroelectric micro-plants. • Hydrological studies of small mountain basins. • Design of small hydraulic structures. • Design of a steam distribution line in a dye-finishing plant. • Evaluation of the effect of wind gusts on the stability of industrial equipment positioned on roofs. • Hydraulic design of fire-extinguishing sprinkler systems. • Safety assessment of pressurized plants and conduits under seismic loads.

Teaching

Academic year: 2014-2015. *University:* Politecnico di Torino.	*Program:* Master degree in "Mechanical Engineering". *Course:* **Industrial fluid mechanics**. *Role:* Teacher assistant.
Academic year: 2015-2016. *University:* Politecnico di Torino.	*Program:* Specializing Master in "Water Engineering for civil, industrial and drinking applications". *Course:* **Management and optimization of water distribution networks**. *Role:* Teacher assistant.
Academic year: 2016-2017. *University:* Politecnico di Torino.	*Program:* Specializing Master in "Water Engineering for civil, industrial and drinking applications". *Course:* **Management and optimization of water distribution networks.** *Role:* Teacher assistant.
Academic year: 2016-2017. *University:* Politecnico di Torino.	*Program:* Master degree in Mechanical Engineering. *Course:* **Industrial fluid mechanics.** *Role:* Teacher assistant.
Academic year: 2017-2018. *University:* Politecnico di Torino.	*Program:* Bachelor degree in Civil Engineering. *Course:* **Hydraulics.** *Role:* Teacher assistant.
Academic year: 2017-2018. *University:* Politecnico di Torino.	*Program:* Bachelor degree in Environmental Engineering. *Course:* **Hydraulics.** *Role:* Teacher assistant.

Capacity building for developing countries

Reference project: "WATSAM"	• Course (in English) "Integrated Urban Water Management" held in the city of Arba Minch (Ethiopia) in May 2014 (total duration of the course 80 hours). • Course (in English) "Training on GIS / GPS systems, hydraulic modeling and planning" held at the Politecnico di Torino in September 2014 (total duration of the course 160 hours). • Mission of capacity building on the numerical modeling of drinking water distribution network for the local water company held in the city of Arba Minch (Ethiopia) in June 2015.

Collaboration with other Universities

Partner University: **École Polytechnique**, Paris (France), Laboratoire d'Hydrodynamique de l'X (LadHyX). *Period:* collaborations since 2013.	*Main collaborator:* Prof. Jean Marc Chomaz. *Main topic of the collaboration:* "Study of the convective-absolute nature of river bedform instabilities" *Joint publications*: paper [3] in the list of the complete scientific production.
Partner University: **Imperial College**, London (UK), Department of Mathematics, Applied Mathematics and Mathematical Physics *Period:* collaborations since 2014.	*Main collaborator:* Prof. Peter Schmid. *Main topic of the collaboration:* "Application of hydrodynamic stability theory to river morphodynamics". *Joint publications*: paper [7] in the list of the complete scientific production.
Partner University: **Tsinghua University**, Department of Civil Engineering, Beijing (China). *Period:* collaborations since 2015.	*Main collaborator:* Prof. Zhihong Zhao. *Main topics of the collaboration*: "Water flow in fractured rock masses" and "Modeling of interactions between roots and fractured rock masses".
Partner University: **Technical University of Braunschweig**, Braunschweig (Germany), Institute for Hydraulics and Water Resources. *Period:* collaborations since 2016.	*Main collaborator:* Ph.D. Francisco Nunez Gonzalez. *Main topic of the collaboration*: "Physical modeling of rivers".
Partner University: **KTH, Royal Institute of Technology**, Stockholm (Sweden). *Period:* collaborations since 2016.	*Main collaborator:* Prof. Luca Brandt. *Main topic of the collaboration*: "Numerical modeling of multiphase cavitating flow for water treatment".

Complete scientific production

Peer reviewed in International Journals

[1] Vesipa R., Camporeale C., Ridolfi L. (2012) **Transient growths of stable modes in riverbed dynamics** *EPL* 100 (6), art. no. 64002.
[2] Vesipa R., Camporeale C., Ridolfi L. (2012) **A shallow-water theory of river bedforms supercritical conditions** *Phys. Fluids* 24 (9), art. no. 094104.
[3] Vesipa R., Camporeale C., Ridolfi L., Chomaz J.M. (2014) **On the convective-absolute nature of river bedform instabilities** *Phys. Fluids* 26 (12), art. no. 1.4902901.
[4] Vesipa R., Camporeale C., Ridolfi L. (2015) **Thin-film-induced morphological instabilities over calcite surfaces** *Proc. R. Soc. A Math. Phys. Eng. Sci.* 471 (2176), art. no. 20150031.
[5] Vesipa R., Camporeale C., Ridolfi L. (2015) **Noise-driven cooperative dynamics between vegetation and topography in riparian zones** *Geophys. Res. Lett.* 42 (19), pp. 8021-8030.
[6] Vesipa R., Camporeale C., Ridolfi L. (2016) **Recovery times of riparian vegetation** *Water Resour. Res.* 52 (4), pp. 2934-2950.
[7] Caruso A., Vesipa R., Camporeale C., Ridolfi L., Schmid P.J. (2016) River **bedform inception by flow unsteadiness: A modal and nonmodal analysis** *Phys. Rev. E* 93 (5), art. no. 053110 .
[8] Vesipa R., Ridolfi L. (2017) **Impact of seasonal forcing on reactive ecological systems** *J. Theor. Biol.* 419, pp. 23-35.
[9] Vesipa R., Camporeale C., Ridolfi L. (2017) **Convective-absolute nature of ripple instabilities on ice and icicles** *Phys. Rev. Fluids* 2 (5), art. no. 053904.
[10] Vesipa R., Camporeale C., Ridolfi L. (2017) **Effect of sampling time in the laboratory investigation of braided rivers** *Water Resour. Res.* 53 (6), pp. 5184-5197.
[11] Vesipa R., Camporeale C., Ridolfi L. (2017) **Effect of river flow fluctuations on riparian vegetation dynamics: Processes and models** *Adv. Water Resour.* 110, pp. 29-50.
[12] Fellini S., Vesipa R., Boano F., Ridolfi L. (2018) **Multipurpose design of the flow-control system of a steep water main** *J. Water Resour. Plann. Manage.* 144 (2), art. no. 05017018.
[13] Vesipa, R., Fellini S. (2018) **Instability of the tank-level control system of long water mains** *J. Hydraul. Eng.* (Under review).
[14] Vesipa R., Ridolfi L. (2018) **Overshoots in the water-level control of hydropower plants** *Renew. Energy* (Under review).

Peer reviewed in Conference Proceedings

Title	Authors	Conference
[15] **Estimating Hydraulic Permeability of Fractured Crystalline Rocks Using Geometrical Parameters**	Vesipa R., Zhao Z., Jing L.	9th International Conference on Analysis of Discontinuous Deformation — New Developments and Applications, ICADD 2010
[16] **Temporal dynamics of the recovery of riparian biomass**	Vesipa R., Camporeale C.,	XXXV Convegno Nazionale di Idraulica e Costruzioni Idrauliche, IDRA 2016

	Ridolfi L.	
[17] **Flow oscillations in a steep water main** (Accepted for publication)	Vesipa R., Fellini S.	XXXVI Convegno Nazionale di Idraulica e Costruzioni Idrauliche, 2018
[18] **Real-time measurement fault detection and remote-control in a mountain water supply system** (Accepted for publication)	Fellini S., Vesipa R., Boano F., Ridolfi L.	XXXVI Convegno Nazionale di Idraulica e Costruzioni Idrauliche, IDRA 2018
[19] **Hydraulics of braided river dynamics. Insights from flume experiments** (Accepted for publication)	Vesipa R., Camporeale C., Ridolfi L.	9th International Conference on Fluvial Hydraulics, RiverFlow 2018
[20] **Real-time measurement fault detection and remotecontrol in a mountain water supply system** (Accepted for publication)	Fellini S., Vesipa R., Boano F., Ridolfi L.	13th Hydroinformatics International Conference, HIC 2018

PhD Thesis

[21] Vesipa R., (2013) **River antidunes and bars: new models and nonmodal analysis** doi: 10.6092/polito/porto/2506431

Technical documents

[22] Vesipa R., Ridolfi L.. (2013) **Linee guida per la valutazione e monitoraggio della compatibilita' ambientale degli impianti idroelettrici sull'ecosistema fluviale. Analisi dei comparti ambientali e valutazione integrata degli impatti relativamente all' idrologia, all'idraulica della corrente, alla morfologia e alla qualità delle acque**.