
Dr. Akshay Patil

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EDUCATION

Ph.D., Civil & Environmental Engineering Environmental Fluid Mechanics Stanford University, Stanford, CA, USA	Sept. 2019 - Jan. 2023
MSc., Hydraulic Engineering Environmental Fluid Mechanics Delft University of Technology, Delft, NL	Sept. 2017 - Aug. 2019
B.E., Civil & Environmental Engineering University of Pune, Pune, IND	Jun. 2012 - Jun. 2016

RESEARCH

Postdoctoral Researcher, Delft University of Technology 3D Geo-information research group Research Focus - Fluid dynamics of the urban and built environment. Advisor - Asst. Prof. Clara García-Sánchez Collaborators - Assoc. Prof. Hugo Ledoux (Delft University of Technology), Asst. Prof. Pedro Costa (Delft University of Technology), Prof. Bernhard Vowinkel (Technical University of Dresden, Germany)	2023 - Current
Graduate Research Assistant, Stanford University Bob and Norma Street Environmental Fluid Mechanics Laboratory Thesis Topic - Direct numerical simulations of wave-current boundary layer over rough walls Advisor - Prof. Oliver Fringer Committee Members - Prof. Stephen Monismith & Prof. Catherine Gorlé	2019 - 2023
Visiting Student, University of Western Australia UWA Oceans Institute, Perth, WA, Australia Thesis Topic - Numerical investigation of nearshore wave transformation and surf-zone hydrodynamics Advisor - Prof. Ryan Lowe Committee Members - Prof. Ad Reniers (chair), Prof. Jeremy Bricker, Dr. Niels Jacobsen, Dr. Chris Lashley, & Dr. Patrick Oosterlo	Summer 2019
Graduate Intern, Arcadis B. V. Rivers, Coasts, and Infrastructure, Zwolle, The Netherlands Research Topic - Numerical investigation of the discharge coefficient for an intake sluice Advisor - Dr. Arjan Tuijnder	Winter 2018
Undergraduate Researcher, University of Pune Central Water and Power Research Station, Pune, India Thesis Topic - Numerical investigation of discharge capacity of an orifice spillway Advisor - Dr. Maruti Bhajantri Committee Members - Dr. Sachin Khandekar & Mr. Amit Kulhare	2015 - 2016

PUBLICATIONS

Patil, A., and Fringer O., (2023), Characterising the roughness in channel flows using direct numerical simulations, *Journal of Hydraulic Engineering*
Contribution: Designed the computational framework, performed the data analysis, and wrote the original draft of the manuscript.

Patil, A., Fringer O., Gorle C., Monismith S., and Stanford University (2023), Direct numerical simulations of wave-current boundary layer over rough walls. Stanford Digital Repository. Available at (DNS dataset - [Click here](#))
Contribution: Generated the dataset.

Patil, A., Fringer O., Gorle C., Monismith S., and Stanford University (2023), Direct numerical

simulations of wave-current interactions over bumpy walls. (Ph.D. Thesis - [Click Here](#))
Contribution: Developed the research plan, implemented the computational framework, performed the data-analysis, and drafted the first version of the manuscript.

Patil, A., and Fringer, O. (2022). Drag enhancement by the addition of weak waves to a wave-current boundary layer over bumpy walls. *Journal of Fluid Mechanics*, 947, A3.
Contribution: Developed the computational fluid dynamics solver with the immersed boundary method, setting up the simulations and performing all the data analysis, and writing the original drafts of the manuscript.

van Gorsel, J., **Patil, A.,** Bricker, J., Pearson, S., Raby, A., Dassanayake. D., Antonini, A. (2021), Numerical Investigation of breaking and broken regular wave forces on a shoal-mounted cylinder (Abstract, page-102 - [Click Here](#))
Contribution: Assistance with computational aspects of the project, weekly meetings and advise on CFD and HPC usage, and reviewing the report draft.

Patil, A., Mudiyanse, S. D., Bricker, J., Uijtewaal, W., Keetels, G., (2018), Effect of overflow nappe non-aeration on tsunami breakwater failure, *Coastal Engineering Proceedings*, 36, 18-18
Contribution: Performed the numerical studies, re-compiled the experimental data with context from the numerical data, revised the original draft of the manuscript.

Patil, A., (2019), Numerical investigation of nearshore wave transformation and surf-zone hydrodynamics (MSc thesis - [Click Here](#))
Contribution: Developing the new computational fluid dynamics solver within OpenFOAM by coupling the waves2Foam and isoAdvector libraries, running all the simulations and data-analysis, and writing the first version of the report.

Patil, A., Monismith, S., and Fringer O., (2024 in prep), Turbulence dynamics over a wave-current boundary layer and applicability of an eddy-viscosity-based turbulence model
Contribution: Conception of the central thesis, performing the simulations and data-analysis, and drafting the first version of the manuscript.

Patil, A., C. García-Sánchez, (2024 in prep), Turbulent kinetic energy dissipation rate characteristics in a wave boundary layer over varying coral reef geometries.
Contribution: Conception of the central thesis, performing the simulations and data-analysis, drafting the first version of the manuscript, and acquiring the funding for the simulations.

Patil, A., C. García-Sánchez, (2024 in prep), Understanding the impact of varying level of detail in urban areas on the wind prediction capabilities using Reynolds-averaged Navier-Stokes models with a focus on urban air-mobility viability.
Contribution: Conception of the thesis, performed the simulations and data-analysis, and wrote the first version of the manuscript.

PRESENTATIONS

Patil, A., and García-Sánchez, C., TURBOCOR-Turbulence over Coral Reefs, Gerhard-Jirka Summer School on Sediment transport in open waters, July 2023, Technical University of Dresden, Dresden, Germany

Patil, A., and Fringer, O., Drag enhancement by the addition of weak waves to a wave-current boundary layer over bumpy walls, (Poster), Fluid Dynamics of Sustainability, and the Environment, Summer School in Fluid Dynamics, June 2022, École polytechnique, Palaiseau, France

Patil, A., and Fringer, O., Direct numerical simulations of wave-current boundary layers over bumpy walls, (Presentation), Western Coastal Collaboratorium Seminar, April 2022, University of Washington, Seattle, WA, USA [Invited talk]

Patil, A., and Fringer, O., Direct numerical simulations of a hydraulically smooth, current-dominated wave-current boundary layer over bumpy walls, (Presentation), Ocean Sciences Meeting 2022, March 2022, Remote Conference

Patil, A., and Fringer, O., Wave-current boundary layer dynamics over bumpy walls, (Presentation), Stanford Environmental Fluid Mechanics Laboratory Seminar, Dec 2021, Stanford, California

Patil, A., and Fringer, O., Exploring the spectral element method for channel flows, (Presentation), Stanford Environmental Fluid Mechanics Laboratory Seminar, June 2020, Stanford, California

Patil, A., and Fringer, O., "Turbulating" a DNS Calculation: A case for OpenFOAM, Splash talk, 15th OpenFOAM Workshop, Virginia Tech, Arlington, VA, USA.

TEACHING

ENV 1800: Atmospheric measurements and modelling, CiTG, Delft University of Technology, Winter 2024

Primary Instructor - Asst. Prof. Clara García-Sánchez

Teaching Assistant - 10% lectures and assisting with development of lab sessions.

GEO 5015: Modelling Wind and Dispersion in Urban Environments, BK, Delft University of Technology Spring 2023

Primary Instructor - Asst. Prof. Clara García-Sánchez

Teaching Assistant - Teaching and assistance during lab sessions.

CEE 101B: Mechanics of Fluids, Stanford University Fall 2021, 2022

Primary Instructor - Prof. Jeffrey Koseff (2022); Prof. Catherine Gorlé (2021)

Teaching Assistant - Prepared and taught supplementary session on a weekly basis. Held weekly office hours and graded the problem sets. Designed midterm and final exams in coordination with the professor.

CEE 262C: Coastal Ocean Modelling, Stanford University Spring 2021

Primary Instructor - Prof. Oliver Fringer

Teaching Assistant - Held review sessions, weekly office hours and programming recitations. Mentored with programming exercises and graded of the problem sets.

THESIS SUPERVISION

O. Post (MSc.) - Random City Engine Aug. 2023 - Current

This project deals with organic development of cities using statistical characterisation of global cities. Held weekly meetings and advising to achieve the research goals for this thesis work.

G. Brouwer (MSc.) - Coral colonies as cities Nov. 2023 - Current

In this project, we try to understand how coral colonies can be viewed through lens of an urban city under water. Held weekly meetings and advising.

S. Zhang (MSc.) - Urban CFD Apr. 2023 - Dec. 2023

Weekly supervision for the MSc. thesis work of Shenghao Zhang. Held weekly meetings to discuss the computational methods, new code development within the open-source direct numerical solver *CaNS* for urban flow applications.

J. v. Gorsel (MSc.) - Wave Cylinder Impact Sept. 2020 - Jul. 2021

Weekly supervision for the MSc. thesis work of Jan van Gorsel (Delft University of Technology). Held weekly meetings and provided assistance with developing a computational plan, analysing data, and scientific writing.

AWARDS

Snellius compute grant, SURFSara, NL 2023

Compute grant for the *TURBOCOR* project supported by *NWO*.

XSEDE Computing Grant, Stanford University 2021 - 2022

Compute grant equivalent to \$409,340 for conducting research on the stampede2 computing cluster at the University of Texas, Texas, USA.

STIR Travel Fund, Delft University of Technology 2019

Travel grant for graduate student equivalent to €400 for research visit to the University of Western Australia, Perth, WA, Australia.

OUTREACH & SERVICE

Reviewer Duties 2023 - Current

- Journal of Geophysical Research: Oceans
- Royal Society A: Mathematical, Physical and Engineering Sciences
- Results in Engineering
- Journal of Hydraulic Engineering

Diversity, Equality, and Inclusion Committee, 3DGeo-Information 2023 - Current

Part of a working group engaged with various aspects of promoting DEI within the 3DGeoInfor-

mation research group and the section of Urban Data Science at the Faculty of Architecture and the Built Environment.

TUrban seminar convener, Delft University of Technology 2023 - Current
Organise and manage the Urban fluid dynamics seminar co-hosted amongst four departments at the Delft University of Technology, Delft, NL.

Seminar Convener, Stanford University 2020-2021
Organised and managed the Environmental Fluid Mechanics seminar for the academic year at the Civil & Environmental engineering department, Stanford University, USA.

SURA Graduate Mentorship Program, Stanford University 2021
Mentored two prospective graduate students at the Civil & Environmental Engineering department

CODE DEVELOPMENT

CaNS - Canonical Navier-Stokes Solver 2023
Public Repository: <https://github.com/CaNS-World/CaNS>
Contributing to the code development of *CaNS* solver originally developed by Asst. Prof. Pedro Costa to include urban fluid dynamics capabilities.

stl2sdf - Signed Distance Field Generator 2023
Soon-to-be published open-source signed distance field generator on Cartesian grid that scales up to 1024 CPUs with minimal memory footprint. Code is implemented in pure Python and uses the *mpi4py* library for the MPI interface.

Dopamine - Channel Flow solver 2021
Public Repository: In-house code made public on request.
Implemented a volume penalisation immersed boundary method within the fast-scalable direct numerical solver for channel flows as part of my Ph.D. thesis.

Waves2Foam + Isoadvector 2019
Public Repository: Waves2Foam-SVN
Coupled a highly accurate geometric volume of fluid method (isoadvector) with the waves2foam library within OpenFOAM as part of my MSc thesis.

TRAINING

University Teaching Qualification - Delft University of Technology Jun. 2023 - Current
Completed the *DEVELOP* and *ASSESS* modules as part of the University Teaching Qualification (UTQ) at the Delft University of Technology. Currently, enrolled in the *SUPERVISE* module. Completing all 4 modules constitute a certification for development and teaching of graduate level courses.

JMBC - Particle-Methods - Eindhoven University of Technology Jan. 2024
Attended the advanced course on particle-based methods by the JM Burgers Fluid Mechanics Center at the Eindhoven University of Technology.

JMBC - Turbulence - Delft University of Technology Nov. 2023
Attended the advanced course on Turbulence physics by the JM Burgers Fluid Mechanics Center at the Delft University of Technology.

Gerhard Jirka Summer School - Dresden, Germany Jul. 2023
One of the 30 participants for the summer school on sediment transport in open waters hosted by the Technical University of Dresden, Germany discussing state-of-the-art sediment transport knowledge.

Fluid Dynamics of Sustainability and Environment - Paris, France Jul. 2022
One of the 45 participants at the FDSE summer school for PhD students hosted by École Polytechnique and Cambridge University to discuss fundamental problems in environmental fluid mechanics and questions relating sustainability.

OpenFOAM training - Delft University of Technology Apr. 2019
Participated in the one-week intensive OpenFOAM development and programming course offered by Håkan Nilsson (Chalmers University, Sweden) at the Delft University of Technology. Course participation was based on an entrance examination and project deliverable at the end of the course.

SKILLS

- **Programming** - Fortran (Modern and Legacy), C, C++, Python, MATLAB, Shell Scripting
- **Parallel Computing** - MPI, OpenMP, FFTW, LAPACK
- **Computational Methods** - Finite Difference and Finite Volume, some experience with Spectral Element methods
- **Computational Fluid Dynamics Software** - OpenFOAM, CaNS, Nek5000

REFERENCES

Asst. Prof. Clara García-Sánchez (*Post-doctoral Advisor*)

Delft University of Technology, Faculty of Architecture and Built Environment, BK West 550,
Delft, The Netherlands
Office (063) 835-1889
Email: c.garcia-sanchez@tudelft.nl

Prof. Oliver Fringer (*Ph.D. Advisor*)

Stanford University, Department of Civil and Environmental Engineering, The Jerry Yang and
Akiko Yamazaki Environment and Energy Building, 473 Via Ortega, Office 187, CA 94305, USA.
Office (650) 450-1137 | Fax (650) 725-9720
Email: fringer@stanford.edu

Prof. Jeremy Bricker (*MSc. Thesis Advisor*)

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2350 Hayward, Ann Arbor, Michigan 48109-2125, USA.
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