Prof. Dr.-Ing. Hemant Sagar

Faculty at Indian Institute of Technology, Roorkee (India)

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01 August 1989

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Are of Research: Multiphase Flow, Numerical Methods (CFD & FEM: nonlinear), Cavitation-Erosion-Noise-Vibration, Slamming, Sloshing, Bubbly Flow, Underwater (sonic) Vehicles, Hydrodynamics of Ships (maneuvering, propulsion and shallow water shipping), Underwater Explosion, Detonation, Quantitative Imaging of Flows and Structures, FSI

Professional Experience

Assistant Professor (Grade-I)

Department of Hydro and Renewable Energy, Indian Institute of Technology, Indian Institute of Technology (IIT), Roorkee

Dec. 2023 – Present

- Teaching: Hydro-mechanical Equipment (HRE-516)

Research Group Leader (Multiphase Flow)

Faculty of Mechanical and Process Engineering, University of Duisburg-Essen, Duisburg, North Rhein-Westphalia, Germany

Sep 2021 – Dec. 2023

- Expertise in multiphase flow (acoustics, slamming, air-gas bubble -dynamics, thermal, optimization) numerical simulations and flow measurements
- Experiments in cavitation tunnel, propeller and cavitation bubble (design and manufacturing of test setup)
- Terahertz, optical and image based quantitative flow measurements
- Optical, vibration, noise and pressure sensor, flow visualization, and highspeed camera
- Management of the laser laboratory experiments (optics, infrared, and visualization)
- Laser ranging experiments for vibration of metal plates (> 100kHz)
- Teaching: Applied CFD (Prof. Milovan Perich), various design and manufacturing aspects
- Guiding 2 doctoral students in the field of multiphase flow, material damage, numerical simulation, hydroacoustic
- FSI simulations (vortex/ flow-induced vibrations of a cylindrical rod, flexible boundaries, and slamming)
- Concept, design, and execution of experiments with computations

Postdoctoral Fellow / Foreign Expert

College of Ship Building, Harbin Engineering University, Harbin, Heilongjiang, China

Jan 2019 - Aug 2021 (2 years 8 months)

- Lead of cavitation laser (single bubble) laboratory
- Numerical Simulations for multiphase flow in a closed water channel
- Computations and experiments for cavitating flow with flow visualization and pressure sensors application
- Development of the experimental concept and experimental investigation
- Cooperation with universities and industry
- Adviser for scientific problems for research assistants
- Scientific evaluation of high-priced and precise scientific equipment

Graduate Research Assistant

University of Duisburg-Essen, Duisburg, North Rhein-Westphalia, Germany

Oct 2013 - Mar 2017 (3 years 6 months)

- Write, discuss and manage project proposals
- Teaching: CFD for compressible flow (Prof. Ould el Moctar)
- CFD, FEM, and FSI simulations of various structures (e.g. offshore structures, etc.)
- Numerical computations of multiphase flow (air, water, steam, and oil)
- Microscopic material polishing, damage, and characterization
- Performing experimental measurements and flow measurement
- High-speed (>50000 fps) flow measurements
- Supervision of 6 master and bachelor theses in the field (development, multiphase flow, material damage, fluid-structure interaction, and flow-induced vibrations)

Executive Engineer Trainee

Greaves Cotton Limited, Pune, Maharashtra, India

Jun 2011 – Feb 2012 (9 months)

- Measurement of engine component vibrations, acceleration sensor, and fatigue tests
- Meshing, FEM analysis for the engine components (crankshaft, crankcase, and connecting rod)

Education

Habilitation (Habil.) Mechanical Engineering, University of Duisburg-Essen, since Sept 2021
The Germany "Habilitation" serves as **evidence of an individual's capability of researching independently and of teaching in a certain subject area**. Traditionally in Germany, a habilitation serves as a formal qualification needed to become a university **professor.**

Doctorate (Dr.-Ing) Mechanical Engineering, University of Duisburg-Essen, Aug 2014 – Aug 2018 (4 Years)
Title of Dissertation: Numerical and experimental investigation of laser-induced cavitation bubbles and induced damage.

Numerical tools: OpenFOAM, StarCCM+, Abaqus
Experimental tools: Laser(1064nm), High-Speed Camera, Matlab, Profilometer, SEM (Scanning Electron Microscope), Confocal Microscope

Master of Science (M.Sc.), Mechanical Engineering, University of Duisburg-Essen, May 2012 – May 2014 (2 Years)
Title of Master Thesis: Numerical Investigation of Fluid-Structure-Interaction during water surface impact on wedge-shaped bodies

Used Tools: StarCCM+, Abaqus, Matlab

Bachelor of Engineering (B. E.), Mechanical Engineering, University of Pune, Aug. 2007 – Aug. 2011 (4 Years)
Title of Bachelor Thesis: 3D-modelling and non-linear FEM-analysis of side-arm charger for coal mine

Used Tools: Catia V5, HyperMesh, and Ansys (Mechanical)

Projects

- **Germany-Korean Funding Program for International Collaboration by DFG-NRF**, "Cavitation Bubble in near wall shear wall flows", Application No. **20230405478230993300, (Principle Investigator)**

- **Tomographic** visualization of travelling air bubbles and bubble cloud, **(Project Lead)**
(Sept 2021- Mar 2022)

  Project Partner: LaVision GmbH

- **INNOSHIP (Projektskizze FKZ: 0303X461)**: Development of an innovative multi-purpose-ship for maintenance and repair of offshore wind turbines. (Jun 2016- Mar 2017) **(Co-Principle Investigator)**

  Project Partners: Innoven GmbH, Voith GmbH & Co. KG

- **SCODEV (Horizon 2020)**: Development of the design concept and aero-hydrodynamic studies of the water scooping device (July 2016 - Mar. 2017) **(Principle Investigator)**
Project Partners: Netherland Aerospace Agency (NLR), Sonaca sa, Jakob Eschbach GmbH, Aerovantage

- **NanoTech-Nanotechnology-Platform**: Characterization of cavitation eroded metal surface
(Dec 2015 – Dec 2015) **(Principle Investigator)**

  Project Partners: Nagoya Institute of Technology Japan, Ruhr University Bochum

- **KONKAV-III** (**BMWi - Förderkennzeichen: 03SX286A):** Development of a cavitation erosion model
(Oct. 2013 – Dec. 2015) **(Co-Principle Investigator)**

  Project Partners: SVA Potsdam, TU Berlin, Ruhr Universität Bochum, HSVA, Hamburg

- Due to non-disclosure agreement, information on three projects is not mentioned here and can't be disclosed.
- Currently three projects are at the stage of submission. Upon request, the overview of these project can be shared via verbal communication. All 3 as PI.

Teaching Experience

- Computational Fluid Dynamics (Compressible Flow) with Prof. Dr.-Ing. Bettar Ould el Moctar (2016-2018)
- Applied CFD with Prof. Milovan Perich (From Winter Semester 2022), design and manufacturing aspects.
- Multiphase flow interaction with solids, (From Summer Semester 2024), own developed course as part of Habilitation.

Professional Certification/Training

- Managing Project Risks and Changes, University of California, Irvin (May 2015 – July 2015)
- Hydrogen Storage, Compression and Transportation (Dec. 2022)

Publications

• Peer-Reviewed International Journal: (Impact factors are updated for year 2023)

(1) Peters A., Sagar H., Lantermann U., El Moctar B., "Numerical methods for prediction of cavitation-erosion", WEAR, 338- 339, pp.189-201, 2015. DOI: https://doi.org/10.1016/j.wear.2015.06.009 **(IF: 5.0)**

(2) Sagar H., El Moctar B., "3-D numerical analysis of a laser-induced cavitation bubble near a solid boundary considering phase change", Ship Technology Research, pp. 1-17, 65(3), 2018. DOI: https://doi.org/10.1080/09377255.2018.1473235 **(IF: 1.673)**

(3) H. J. Sagar, S. Hanke, M. Underberg, C. Feng, O. el Moctar, S. A. Kaiser, "Experimental and numerical investigation of damage on an aluminum surface by single-bubble cavitation", pp.- 985-1003, vol. 7, issue 5. ASTM- Materials Characterization and Performance (MPC), 2018. DOI: https://doi.org/10.1520/MPC20180038 **(IF: 1.26)**

(4) H. Sagar, B. el Moctar, "Dynamics of a cavitation bubble near a solid surface and the induced damage", Journal of Fluids and Structures, 92(102799), 2020. DOI: http://doi.org/10.1016/j.jfluidstructs.2019.102799 **(IF: 3.6)**

(5) Kadivar, E., el Moctar, O., Sagar, H., "Experimental study of the influence of mesoscale surface structuring on single bubble dynamics", Ocean Engineering, vol. 260, 2022. DOI: https://doi.org/10.1016/j.oceaneng.2022.111892 **(IF: 5.0)**

(6) H. J. Sagar, B. el Moctar, "Dynamics of a cavitation bubble between oblique plates", Physics of Fluids, 2023, 35(1), 013324

DOI: https://doi.org/10.1063/5.0132098 **(IF: 4.6)**

(7) M.-K. Li, S. Wang, and Shuai Zhang, H. J. Sagar, "Experimental study of underwater explosions below a free surface: bubble

dynamics and pressure wave emission", Physics of Fluids, 2023, 35(1), 083313. DOI: https://doi.org/10.1063/5.0155177 **(IF: 4.6)**

(8) He M., Zhang S., Wang S.-P., Sagar H. J., “Refined numerical investigation of a large equivalent shallow-depth underwater explosion”, AIP Advances, vol. 13, 2023. DOI: https://doi.org/10.1063/5.0156558 **(IF: 1.6)**

(9) Sagar H. & el Moctar B., “A Single Cavitation Bubble Collapse Induced Hydroelasticity Effects”, 2023 (in review at Fluids and Structures) https://dx.doi.org/10.2139/ssrn.4689749

(10) Sagar H., Lin. Y. & el Moctar B., “Dynamics of a cavitation bubble near an oscillating boundary”, 2023 (in review at Nature Scientific Reports)

(11) D.-W.- Han, Hemant J. Sagar* & et al., “Dynamics of a single cavitation bubble near a cylindrical blind hole” 2024 (in review at Physics of Fluids) (POF23-AR-10685)

(12) Q.-T.- Nguyen, Hemant J. Sagar* & et al., “Effects of oscillating curved wall on behavior of cavitation bubble collapse” 2024 (in review at Physics of Fluids) (POF23-AR-07756)

• Peer-Reviewed International Conferences:

(1) Sagar H., Ley J., El Moctar B., "Hydroelasticity effects of wave loading on monopile foundation", 7th International Hydroelasticity Conference in Marine Technology, Split (Croatia) Sept. 2015.

(2) Reuter F., Sagar H., El Moctar B., “Wall shear rates induced by a single cavitation bubble collapse”, The 10th International Symposium on Cavitation (CAV2018), Baltimore, Maryland (USA), May 2018.

(3) Sagar H., el Moctar B., “A Single Cavitation Bubble Induced Damage”, 41st International Conference on Ocean, Offshore & Arctic Engineering (OMAE), Hamburg (Germany), June 2022.

(4) Sagar H., el Moctar B., “A Single Cavitation Bubble Collapse in Perspective of Numerical Simulations”, Numerical Towing Tank Symposium (NuTTS), Mülheim an der Ruhr (Germany), Oct. 2021

(5) Sagar H., el Moctar B., “Bubble dynamics in restricted passages”, Numerical Towing Tank Symposium (NuTTS), Zagreb (Croatia), Oct. 2022

(6) Sagar H., el Moctar B., “Bubbly between Oblique Plates”, MARINE, Madrid (Spain), June 2023

(7) Sagar H., el Moctar B., “Hydroelasticity effects of single cavitation bubble dynamics”, Numerical Towing Tank Symposium (NuTTS), Ericeira (Portugal), Oct. 2023

(8) Sagar Hemant, “Consequences of Cavitation Bubble Dynamics in Diffuser Domain”, Current Research in Hydropower Technologies, (CRHT-XII), Kathmandu, March 2024

(9) Sagar H., el Moctar B., “Experimental investigation of hydroelasticity effects of single cavitation bubble dynamics”, Symposium of Naval Hydrodynamics (SNH), Nantes (France), July 2024

• Non-Peer-Reviewed International Conferences:

(1) Peters A., Sagar H., Lantermann U., El Moctar B., "Numerical modeling and prediction of hydrodynamic cavitation- erosion", Kolloquim Kavitation und Kavitationserosion, Bochum (Germany), Nov. 2014.

(2) Peters A., Sagar H., Lantermann U., El Moctar B.," A new approach for a cavitation-erosion model", ICCFD 8, 2014. (3) Sagar H., Peters A., El Moctar B., “Numerical Investigation of Laser-Induced Cavitation Bubble Collapse near Solid Wall”, DNV-GL workshop, Hamburg (Germany), Jan. 2016.

(3) Sagar H., el Moctar B., “Experimental and numerical investigation of laser induced bubble collapse near solid wall”, Stand der Maritimen Forschung in Deutschland - Ship Technology Research (STR), Hamburg (Germany), June 2018.

(4) Stefanie Hanke, Hemant J. Sagar, Chaojie Feng, Martin Underberg, Ould el Moctar, Sebastian A. Kaiser, “Variations in cavitation bubble dynamics and their effects on the resulting surface indentations on commercially pure Aluminium”, Materials Science and Engineering Congress, Darmstadt (Germany), Sept. 2018

(5) Sagar H., S. Hanke, S. Kaiser, el Moctar B., “A damage induced by single bubble cavitation collapse”, Kolloquim Kavitation und Kavitationserosion, Bochum (Germany), Nov. 2018

(6) Sagar H., el Moctar B., “Destructive Dynamics of a Cavitation Bubble near Metal Surface”, MULTIPHASE 2022, Wageningen (Netherlands), Sept. 2022

(7) Sagar H., el Moctar B., “Bubbly between non-parallel surfaces”, Kolloquim Kavitation und Kavitationserosion, Mülheim an der Rühr (Germany), Nov. 2022.

(8) Sagar H., el Moctar B., “Cavitation Bubble Dynamics Near Brittle Boundaries” 2nd wprkshop on Cavitation Exploitation, Ljublana (Slovenia), Sept. 2023.

(9) Sagar H., el Moctar B., “Fluid-Structure Interaction between Single Cavitation Bubble & Elastic Metal Foil” Workshop on Cavitation, Drübeck (Germany), Nov. 2023.

Reviewer: Physics of Fluids, Wear, Nature Scientific Reports, Ocean Engineering, Fluids and Structures

Guest Editor: Special Issue "Numerical Modeling and Experimental Studies of Two-Phase Flows", FLUIDS

Skills

- **Computation:** StarCCM+, OpenFOAM, Abaqus, Catia V5, Autodesk Inventor, Solidworks
- **Operating system:** Linux, Windows
- **Office:** MS Word, Excel, Latex
- **Programming:** Matlab, Python
- **Languages:** English (C1), German (B2), Hindi (C1)

- **Experiments:** Highspeed camera, image processing, optical and piezoelectric vibration sensors, noise detection

Awards

- Doctoral Scholarship, Universität Duisburg-Essen (Apr. 2017 – Oct. 2018)
- Weinbluhm Best Dissertation Award, 2019 (nomination)

References:

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Dr.-Ing. Hemant J. Sagar

Duisburg, 23 March, 2024