IAHR
AIRH
International Association for Hydro-Environment Engineering and Research

Hosted by
Spain Water and IWHR, China

IAHR 2024

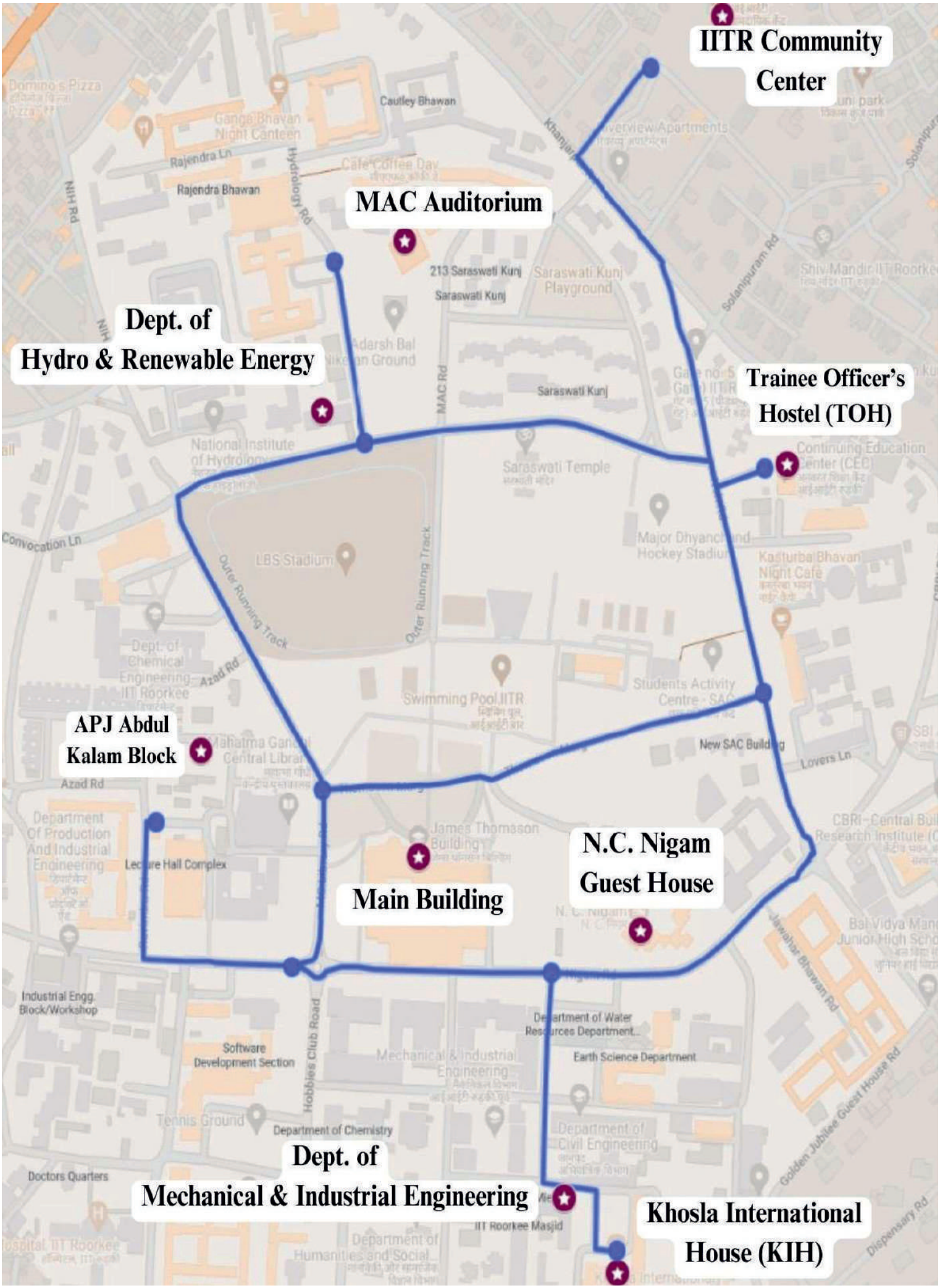
32nd SYMPOSIUM ON HYDRAULIC MACHINERY AND SYSTEMS

SEPTEMBER 11 – 14, 2024

DEPARTMENT OF HYDRO AND RENEWABLE ENERGY

DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE


IITR Community Center
MAC Auditorium
Dept. of Hydro & Renewable Energy
Trainee Officer's Hostel (TOH)
APJ Abdul Kalam Block
N.C. Nigam Guest House
Main Building
Dept. of Mechanical & Industrial Engineering
Khosla International House (KIH)
Cautley Bhawan
Rajendra Bhawan
Saraswati Kunj
Saraswati Temple
LBS Stadium
Swimming Pool,IITR
Students Activity Centre - SAC
Lecture Hall Complex
Department Of Production And Industrial Engineering
Industrial Engg. Block/Workshop
Software Development Section
Department of Chemistry
Doctors Quarters
Earth Science Department
IIT Roorkee Masjid
Azad Rd
Outer Running Track
MAC Rd
Hydrology Rd
Solanipuram Rd
Golden Jubilee Guest House Rd
Dispensary Rd
Lovers Ln
Convocation Ln

Programme at a Glance

International Association for Hydro-Environment Engineering and Research
Hosted by Spain Water and IWHR, China

32nd IAHR Symposium on Hydraulic Machinery and Systems

Indian Institute of Technology Roorkee, India

September 11 – 14, 2024

जल एवं नवीकरणीय ऊर्जा विभाग
DEPARTMENT OF HYDRO AND RENEWABLE ENERGY

यांत्रिक और औद्योगिक इंजीनियरिंग विभाग
DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING

(As on Sept 07, 2024)

10.09.2024							1830 hrs onwards Welcome Reception followed by Dinner	
Time (hrs)	0900- 1030	1030-1100	1100-1300	1300-1430	1430-1630	1630-1700	1700-1830	1830 onwards
11.09.2024 (Day 1)	0900- 0945 hrs **Registration** 0945-1030 hrs **Inaugural Session**	Tea Break	**Plenary Session-1 (PS 1)** (Keynote)	Lunch Break and Networking	**Technical Session-1 (TS-1)** • Hydraulic Turbines [4] • Pump-Turbines [5] • Fluid-structure interaction and fatigue loading [5]	Tea Break	**Technical Session-2 (TS-2)** • Hydraulic Turbines [4] • Pump-Turbines [4] • Hydropower [1] • Energy Storage and Flexibility [2]	**IAHR Executive Committee Meeting** 1900 onwards **Cultural Event** MAC **Dinner** Community Centre
12.09.2024 (Day 2)	**Plenary Session-2 (PS 2)** (Keynote)		**Technical Session-3 (TS-3)** • Hydraulic Turbines [5] • Pump-Turbines [4] • Energy Storage and Flexibility [4]		**Technical Session-4 (TS-4)** • Hydraulic Turbines [5] • Computational Fluid Dynamics [6] • Multiphase Flow [4]		**Technical Session-5 (TS-5)** • Hydraulic Turbines [3] • Pump-Turbines [3] • Vortex Breakdown [3]	1930 onwards **Gala Dinner**
13.09.2024 (Day 3)	**Plenary Session-3 (PS 3)** (Keynote)		**Technical Session-6 (TS-6)** • Hydraulic Turbines [4] • Recent Measurement Techniques [3] • Multiphase flow [3]		**Technical Session-7 (TS-7)** • Hydraulic Turbines [3] • General Topics [5]		**Valedictory Session**	
14.09.2024 (Day 4)	Technical Tour to Pathri (1955) and Chilla (1982) hydropower stations, Pashulok barrage, Ganga Aarti 0830 hrs Departure from IIT Roorkee and return by 2000 hrs. Lunch and Snacks shall be by host during the tour.							

PREFACE

Hydropower is a reliable, versatile, and low-cost source of clean electricity generation and responsible water management. Hydropower plants are helping to accelerate the clean energy transition, providing essential power, storage, flexibility, and climate mitigation services. Hydropower is also a key asset for building secure, clean electricity systems and reaching global net-zero targets. Hydraulic machinery is an essential component of a hydropower plant to generate electricity. It is always vital to share current knowledge on research and development, including numerical analysis, design, operation, and monitoring of hydraulic machinery and systems. Research and development from academia and industry have constantly been improving the hydraulic turbine and components design.

The 32nd IAHR symposium on Hydraulic Machinery and Systems offers an opportunity for academic researchers and industrial experts from all over the world to share recent advances in theoretical, experimental, and computational research as well as the challenges faced by the industry.

This biennial Symposium is jointly organized by the Department of Hydro and Renewable Energy and Department of Mechanical and Industrial Engineering and is being held at the Indian Institute of Technology Roorkee, India during September 11-14, 2024. The symposium bringstogether national and international expertson a common platform to share knowledge on various hydraulic machinery related topics. The symposium includes original research articles within the scope of the below-mentioned technical tracks.

- Intake systems
- Hydraulic turbines
- Pump turbines
- Hydropower
- Multiphase flow
- Vortex breakdown
- Recent measurement techniques
- Computational fluid dynamics (CFD)
- Fluid-structure interaction and fatigue loading
- Ocean hydro machinery
- Energy storage and flexibility
- General topics

INSTITUTE AND ORGANIZERS

Indian Institute of Technology Roorkee

Indian Institute of Technology Roorkee (IIT Roorkee) is among the foremost institutes of national importance in higher technological education and engineering, basic and applied research. Since its establishment, the Institute has played a vital role in providing the technical workforce and know-how to the country and pursuing research. The Institute ranks amongst the best technological institutions globally and has contributed to all sectors of technological development. It has also been considered a trend-setter in the area of education and research in the field of science, technology, and engineering. The Institute has celebrated its demisemiseptcentennial (175 years) of establishment during 2021-22.

James Thomson Building, Indian Institute of Technology Roorkee

Department of Hydro and Renewable Energy

Department of Hydro and Renewable Energy (HRED) formerly Alternate Hydro Energy Centre, an academic department of Indian Institute of Technology, Roorkee was established in the year 1982. HRED has been providing professional supports in the field of Small Hydropower Development covering planning, Detailed Project Reports, Detailed Engineering Designs and Construction drawings, Technical Specifications of Turn-Key execution/equipment Supply, Refurbishment, Renovation and Modernisation of SHP Stations, Techno-Economic Appraisal, R&D/Monitoring of Projects, Remote Sensing and GIS Based Applications. Technical support to over 25 different state and central government organizations for SHP development has been provided. IPPs and financial institutions are utilizing its expertise and support for their SHP development. HRED also worked on several projects related to the conservation and management of water bodies.

Department of Hydro and Renewable Energy, IIT Roorkee

Department of Mechanical and Industrial Engineering

The Department of Mechanical Engineering (MIED) came into being in the year 1946 and the first batch of Mechanical Engineers graduated in the year 1949. The department was renamed as Department of Mechanical & Industrial Engineering on its silver jubilee in 1974 when an undergraduate programme in Industrial Engineering was started. At present it offers both undergraduate and postgraduate courses in various facets of Mechanical and Industrial Engineering. The department offers Master of Technology courses in Machine Design Engineering, Production and Industrial Systems Engineering, Thermal System Engineering, Welding Engineering and CAD, CAM, and Robotics. The department has laboratory and workshop facilities with modern sophisticated equipment to conduct research in all areas related to Mechanical and Production & Industrial Engineering. The faculty actively participates in sponsored research and consultancy work.

Department of Mechanical and Industrial Engineering, IIT Roorkee

ORGANIZING COMMITTEE

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DIRECTOR IITR, PATRON

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SYMPOSIUM CHAIR

PROF. BHUPENDRA K. GANDHI
SYMPOSIUM CO-CHAIR

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2.	Session Management	1. Prof. Chandra Shekhar Pant 2. Prof. Krishna Mohan Singh 3. Shri Rahul Shrivastava 4. Shri Ankit Dubey 5. Shri Manish Pipal 6. Ms Jyoti Pal 7. Shri Hitesh Kumar Sinha 8. Shri Shivam Tiwari
3.	Inaugural and Valedictory function	1. Prof. Nikhil Singh 2. Shri Rohit Rana
4.	Compering	1. Prof. Himanshu Jain 2. Dr. Ankita Bhatt
5.	Exhibition	1. Prof. Pratham Arora 2. Prof. Sunil Kumar Singal 3. Shri Upendra Bajpai
6.	Catering	1. Prof. Sunil Kumar Singal 2. Prof. Himanshu Jain 3. Shri Ravinder Singh 4. Shri Prashant Kumar
7.	Accommodation & Transportation	1. Dr. Naman Arora 2. Dr. Nitin Kumar Jhankal 3. Shri Ankit Kumar Gupta
8.	Cultural Programme	1. Prof. Himanshu Joshi 2. Prof. Rhythm Singh
9.	Conference proceedings	1. Dr. Naman Arora 2. Shri Bhushan Ravindra Rode
10.	Banners/poster/signage	1. Dr. Arnab Mukherjee 2. Dr. Subodh Khullar 3. Dr. Sandeep Kumar
11.	Handling of VIPs	1. Prof. Rhythm Singh
12.	Hall management	1. Prof Hemant Jibhau Sagar 2. Shri Shubham Mallik
13.	Registration	1. Shri Udit Batra 2. Shri Rahul Vishwakarma 3. Shri Nitish Prasad 4. Ms. Juhi
14.	Guest and key speakers handling	1. Prof. Ravita Lamba 2. Shri Omprakash Yadav
15.	Overall Coordination	1. Prof. Arun Kumar 2. Prof. Bhupendra Kumar Gandhi

SYMPOSIUM THEMES

1. **Intake systems**

This section covers the research topics related to the intake systems of a hydropower plant, including diversion structure, intake gate, trash rack, desilting structure, water conductor system, main inlet valve, surge tank, fatigue loading in penstock, hydraulic transient, etc.

2. **Hydraulic turbines**

This section covers all the components of hydraulic turbines, such as spiral casing, stay vane, guide vane, runner, labyrinth seals, and draft tube. The potential areas of interest are design and optimization, multidisciplinary design optimization, unsteady flow phenomena, performance prediction and enhancement, erosion and cavitation flow, etc.

3. **Pump turbines**

This section covers all topics related to a centrifugal pump, pump as turbines, reversible pump turbines, including its design, optimization, performance, cavitation, vibration, phenomena in pumping and turbine mode, etc.

4. **Hydropower**

This section covers topics related to sustainable development and challenges in the hydropower projects, including small hydropower, mini and micro-hydro, decentralized development, load flexibility, environmentally friendly turbine design, innovations in sustainable hydro, and energy-efficient application, etc.

5. **Multiphase flow**

This section covers topics related to two or more phases of flow study in the hydraulic machinery, including cavitation, erosion, aeration, synergic effect, etc.

6. **Vortex breakdown**

This section covers topics related to vortex breakdown in hydraulic machinery, including trailing edge vortex, leading-edge vortex, inter blade vortex, draft tube, etc.

7. **Recent measurement techniques**

This section covers topics related to recent measurement techniques used in hydropower plants, including efficiency, pressure, velocity, strain, and vibration. It also focuses on the measurement techniques of suspended sediment and hydro abrasive erosion in the hydraulic machinery.

8. Computational fluid dynamics (CFD)

This section covers topics related to numerical techniques used in hydraulic machinery. The potential area of interest is high-quality CFD simulations, development of numerical models, turbulence modeling, detached eddy simulations, large-eddy simulations, direct numerical simulations, etc.

9. Fluid-structure interaction and fatigue loading

This section covers experimental or numerical analysis topics, including fluid-solid interaction, vibration, resonance, damping, stress-strain measurement, crack development, estimating fatigue lifetime, finite element method, etc.

10. Ocean hydro machinery

This section covers wave energy, tidal energy, and marine current energy topics. It focuses on the ocean hydro types of machinery mainly used to convert the ocean hydropower into mechanical energy to generate electricity finally.

11. Energy storage and flexibility

This section covers topics related to hydropower energy storage, market, scheduling, energy management, transient operations such as load variation, start-stop, load rejection, no-load, runaway. Energy generation and management with multiple turbines, load sharing, ancillary services, load ramping are potential areas of interest.

12. General topics

This section invites the topics which are not covered in the above sections and are explicitly in the context of hydropower and hydraulic machinery e.g., recent manufacturing techniques for hydraulic turbines, refurbishment, life assessment, turbine testing, calibration method, prototyping, scaling, turbine blade material and metallurgy, data acquisition and data processing.

KEYNOTE SPEAKERS

Prof. Stefan Riedelbauch

Director
Institute of Fluid Mechanics and
Hydraulic Machinery
University of Stuttgart, Germany

Prof. Stefan graduated in Mechanical Engineering at the Technical University of Munich, Germany in 1986. He then worked at the German Aerospace Center (DLR) in Goettingen on Hypersonic Aerodynamics and obtained his PhD at the Technical University of Munich in 1991. Between 1992 and 2010 he worked with Voith Hydro in Heidenheim, Germany and York, PA, USA and had been involved in different technical activities and positions with a focus on Hydro Power.

Among those were numerical flow field simulation, turbine design for new plants and modernization including model testing, head of turbine product development and Chief Engineer of turbine and generator engineering. In 2010, he became full Professor and is currently Director of the Institute of Fluid Mechanics and Hydraulic Machinery at the University of Stuttgart, Germany.

Prof. Ole Gunnar Dahlhaug

Professor
Department of Energy and Process Engineering
Faculty of Engineering
Norwegian University of Science and Technology, Norway

Prof. Ole received his MSc in Mechanical Engineering in 1992, finished PhD from Norwegian University of Science and Technology in 1997, and received a Professorship in hydro turbine technology in 2005. He has been working with hydropower technology since 1992, and in addition to the work on Norwegian hydropower plants, he has worked on sediment erosion in hydropower plants in Nepal, Peru, and Chile.

His expertise and competence are mainly in the fields of mechanical equipment in hydropower stations, efficiency measurements of prototype pumps and turbines, laboratory tests of pumps and turbines, centrifugal pump and reversible pump turbines, Francis and Pelton turbine design, sediment erosion in hydro turbines, fatigue loads in hydro turbines, maintenance of hydro turbines.

Prof. Zhengwei Wang

Professor, Doctoral tutor
Department of Thermal Engineering,
Tsinghua University, China

Prof. Wang completed his masters in Hydraulic machinery at Department of Electric Powering Engineering, Huazhong University of Science & Technology in 1992 and finished his PhD in 1996 at Department of Hydropower Engineering, Tsinghua University.

He started his career as a lecturer at Institute of Fluid Machinery and Fluid Engineering, Tsinghua University in 1996. Since 2007, he has been serving as a Professor, Doctoral tutor, Research team leader, and Director of Institute of Fluid Machinery and Fluid Engineering, Tsinghua University.

His research areas include Multiphase transient flow theory and flow control of hydraulic machinery, Multi field coupling theory and basic research on engineering application of hydraulic machinery, and Research on intelligent and green informatization of hydraulic equipment and system.

Prof. Wang's research team has developed a tidal generator set which has been successfully applied to Jiangxia tidal test power station with bidirectional turbines, pumps and discharge operation and also, they have developed and designed more than 80 sets of runners which operated efficiently and safely in many hydropower stations and pumping units.

Prof. Chisachi Kato

Senior Researcher, Research Institute of Science and Technology
College of Science and Technology
Nihon University
Professor Emeritus, The University of Tokyo, Japan

Prof. Chisachi Kato is a senior researcher at the Research Institute of Science and Technology, College of Science and Technology, Nihon University. He specializes in fluid mechanics/engineering, computational and experimental fluid dynamics/ aeroacoustics, turbomachinery, automobile engineering, and ship hydrodynamics. Upon graduation from the University of Tokyo in 1984, he joined and worked as a research engineer for about 15 years at the Mechanical Engineering Research Laboratory of Hitachi, Ltd. In 1995, he was conferred his doctoral degree in engineering from the University of Tokyo. In January 1999, he moved to the Institute of Industrial Science (IIS) at the University of Tokyo and was appointed as a professor in January 2003. He retired from the University of Tokyo in March 2024 and moved to the present position in April 2024.

Prof. Kato has consecutively led many government-funded projects aimed at the development and diffusion of large-scale application software for use in related industries, which has resulted in more than 110,000 downloads of the developed software.

Prof. Kato has also served as the vice chair, the chair, and the president of many domestic as well as overseas academic societies. Recently, Prof. Kato served as the President of the High-Performance Computing Infrastructure Consortium from May 2018 to April 2020, the President of the Turbomachinery Society of Japan from May 2019 to April 2021, the President of the Japan Society of Mechanical Engineers from April 2022 to March 2023, the Chair of Asian Fluids Machinery Committee (AFMC) from September 2017 to December 2023, and the Vice Chair of the IHAR Hydraulic Machinery and Systems committee from September 2018 to present.

Prof. Pavel Rudolf

Head
Victor Kaplan Department of Fluid Engineering
Energy Institute
Faculty of Mechanical Engineering
Brno University of Technology, Czech

Prof. Pavel joined the Faculty of Mechanical Engineering, Kaplan Department of Fluid Engineering, Brno University of Technology as an assistant lecturer in the year 1999 and currently serving as an associate professor and head of Victor Kaplan Department of Fluid Engineering. He had been associated with the Universität of Stuttgart, Institut für Hydraulische Maschinen und Strömungslehre, Technische Universität München, Politehnica Timisoara, and the University of Warwick.

He is serving as a member of IAHR Hydraulic Machinery and Systems Committee, Czech pilot center ERCOFTAC (representative for FME BUT), and European society for mechanics EUROMECH.

SPEAKERS FROM HYDROPOWER INDUSTRY

1. **Andritz Hydro Pvt. Ltd.**	ANDRITZ
2. **Voith Hydro Pvt. Ltd.**	VOITH
3. **Jyoti Ltd.**	Jyoti Ltd. Water • Power • Progress
4. **Kirloskar Brothers Ltd.**	Kirloskar Enriching Lives KIRLOSKAR BROTHERS LIMITED
5. **Flovel Energy Pvt. Ltd.**	FLOVEL Advantage on your side

SYMPOSIUM PROGRAM

Day 0: Sept. 10, 2024 (Tuesday)

Time (hrs)	Particulars	Venue
1830 onwards	Welcome Reception followed by Dinner	Community Centre

Day 1: Sept. 11, 2024 (Wednesday)

Time (hrs)	Session	Particulars	Venue
0945 – 1030	Inaugural Session	Prof. Kamal Kishore Pant, Director IIT Roorkee Prof. Stefan Riedelbauch, University of Stuttgart, Germany	APJA Kalam Block Room No. 103
1030 – 1100	High Tea		APJA Kalam Block Lawn
1100 – 1300	Plenary Session-1 (PS1) **Session Chair:** Prof. Krishna Mohan Singh	**Keynote Speaker:** Prof. Stefan Riedelbauch, University of Stuttgart, Germany **Topic:** Methods to Investigate Operational Transients Towards an Increased Flexibility of Hydraulic Machinery	APJA Kalam Block Room No. 103
		Keynote Speaker: Prof. Ole Gunnar Dahlhaug, NTNU, Norway **Topic:** Flexibility from Hydropower	
		Address by Andritz Hydro Pvt. Ltd.	
		Address by Voith Hydro Pvt. Ltd.	
1300 – 1430	Lunch Break		Community Centre

Technical Session-1 (TS1)

	Paper ID	Paper Title	Presenting Author	
1430 – 1630 Parallel Session Hydraulic Turbines **Session Chair:** Prof. Rahul Goyal	128	Flow Analysis and Optimization Study of Main Components of Flow-Type Small Hydro Turbine System	Seong-Han Bae	APJA Kalam Block Room No. 102
	20	Effects of Load Reduction on Forces and Moments on the Runner Blades of a Kaplan Turbine Model	Martina Nobilo	
	21	Analysis of the Flow Discharge and Losses from an Eroded Bucket on the Pelton Turbine	Jim Abregu	
	25	Practical Evaluation Method for Oil Level Height in Turbine Self-Lubricated Guide Bearing	Gaku Nara	
Parallel Session Pump Turbines **Session Chair:** Dr. Ali Abbas	144	Investigating the Impact of Stagger Angle on Double Suction Pump Performance Through Computational Fluid Dynamics	Arihant Sonawat	APJA Kalam Block Room No. 103
	11	Pump Start Instability on a Low Head Pump Turbine and Testing with Partial Deaeration	Bernd Nennemann	
	23	Experimental Investigation of a FSFC Variable Speed Pump-Turbine Prototype - Part1: Penstock Fatigue Reduction and Fast Active Power Regulation	Christophe Nicolet	
	138	Numerical study of pressure fluctuation in vaneless space of variable speed reversible pump-turbine in turbine mode at	Bhushan Ravindra Rode	

Time (hrs)	Session	Particulars			Venue
			maximum head		
		154	Effect of Wrap Angle on Performance of Pump as Turbine (PAT) in both Pump and Turbine Modes	Anant Rai	
	Parallel Session Fluid Structure Interaction & Fatigue Loading **Session Chair:** Prof. Ole Gunnar Dahlhaug	63	Experimental Facility Dedicated to Detection and Prediction of Penstock Fatigue Induced by Pressure Oscillations	Vlad Hasmatuchi	APJA Kalam Block Room No. 104
		84	Evaluation of the Fatigue-Related Influence of Start-Ups on Pelton Turbines Based on Reduced Scale Model Stress Measurements	Aldo Leonardo Alerci	
		86	Numerical Prediction of the Fluid Damping of a Standing Disc with a Variable Axial Distance from a Rigid Wall	Karim Khalfaoui	
		117	Advancing the Reliability of Residual Life Assessment for Turbines Through Strain Gauge Measurements: Key Aspects and Latest Developments	Florian von Locquenghien	
		136	On the Modelling of the Fatigue-Induced Damage in Francis Turbines Start-Up Sequences	Elena Vagnoni	
1630 – 1700	Tea Break				APJA Kalam Block Lawn
1700 – 1830	**Technical Session (TS2)**				
		Paper ID	**Paper Title**	**Presenting Author**	
	Parallel Session Hydraulic Turbines **Session Chair:** Prof. Nikhil Kumar Singh	26	Chain-Reaction Collapse of Cavitation Clouds in Francis Turbine Runner During Start-up	Takero Mukai	APJA Kalam Block Room No. 103
		36	Assessment of Wear-Resistance in Hydro Turbine Steel: The Impact of Sediment Erosion on a Metal-Ceramic Coating	Ashwin Pandey	
		51	Mitigation of Vibrations Caused by Inter-Blade Vortices Using a Pumping Cap for Natural Aeration	Samer Afara	
		116	Influence of Labyrinth Clearance on the Hydrodynamic Performance of a High Head Francis Turbine	Md. Mustafa Kamal	
	Parallel Session Pump Turbines **Session Chair:** Prof. Chisachi Kato	80	Increasing Grid Flexibility – Implementation and Testing of Improved Start and Mode Change Procedures in a PSPP With Double-Fed Induction Machines and Reversible Pump-Turbine	Alexander Jung	APJA Kalam Block Room No. 102
		89	Numerical Analysis and Runner Shape Optimization of a High Head Pump-Turbine	Denis Chirkov	
		29	Influence of Pump Turbine Impeller Blade Angles on the Unsteady Flow Phenomena and “S-Curve “Characteristics Region	Shrestha Ujjwal	
		64	Experimental Investigation of a FSFC Variable Speed Pump-Turbine Prototype – Part2: Runner Fatigue Reduction	Daniel Biner	
	Parallel Session Hydropower and Energy Storage & Flexibility **Session Chair:** Prof. Alexander Presas	46	A Machine Learning Based Analysis of Bearing Vibrations for Predictive Maintenance in a Hydropower Plant	Hakan Nilsson	APJA Kalam Block Room No. 104
		14	Water Hammer Control of Pumped-Storage Power Plant with Two Units under Hydraulic Short Circuit Operation	Zilong Cui	
		17	Multi-Scale Oscillation of Pumped Storage - Wind Power Coupling System with Surge Tanks	Jiening Li	
1830 onwards	**IAHR Executive Committee Meeting**				
1900 onwards	**Cultural Event**				MAC
	Dinner				Community Centre

Day 2: Sept. 12, 2024 (Thursday)

Time (hrs)	Session	Particulars	Venue
0900 – 1030	Plenary Session-2 (PS2) **Session Chair:** Dr. Martin Rentschler	**Keynote Speaker:** Prof. Chisachi Kato, Nihon University, Japan **Topic:** Industrial Applications of Wall-Resolving Large Eddy Simulation to Turbomachinery- Present Status and Future Perspectives **Keynote Speaker:** Prof. Zhengwei Wang, Tsinghua University, China **Address by Jyoti Ltd.**	APJA Kalam Block Room No. 103
1030 – 1100	High Tea		APJA Kalam Block Lawn

Technical Session (TS3)

		Paper ID	Paper Title	Presenting Author	
1100 – 1300	Parallel Session Hydraulic Turbines **Session Chair:** Prof. Elena Vagnoni	61	Investigations on Various Hardcoating Technologies	Reiner Mack	APJA Kalam Block Room No. 103
		69	Signature Investigation of Misaligned Jet in Pelton Turbines Due to Flow Obstruction in Nozzle	Sailesh Chitrakar	
		75	On the Effect of Flow Rate on Pressure Fluctuations and Cavitation Characteristics in a Novel Bulb Turbine	Sonal Shandilya	
		153	A Comparative Analysis of CFD Methodologies to Predict the Performance of Francis Turbine	Arnab Mukherjee	
		77	Numerical Study of Flow Phenomena and Erosion in Three Guide Vane Cascade Rig	Kushal Shrestha	
	Parallel Session Pump Turbines **Session Chair:** Dr. Christophe Nicolet	94	Analysis the Pump Model Cavitation with Small Guide Vane Opening of Pump-Turbine	Xiao Yexiang	APJA Kalam Block Room No. 104
		101	Analysis of Pump Model Pressure Fluctuation Characteristics Under Different Rotation Speeds of a Francis Pump-Turbine	Xiao Yexiang	
		71	The Effects of Flow Rate on the Performance of Centrifugal Pump as Turbine Based on Entropy Production Theory	Yunqi Liu	
		72	Study on Optimization Design of Pump Turbine with High Head Based on CFD Technique	Yang Zheng	
	Parallel Session Energy Storage & Flexibility **Session Chair:** Prof. Sunil Kumar Singal	33	Analysis of Mode-Switching of a Contra-Rotating Pump-Turbine Based on Load Gradient Limiting Shutdown and Startup Sequences	Hakan Nilsson	APJA Kalam Block Room No. 102
		79	Increasing Grid Flexibility Through Ancillary Services – Results of Virtual Inertia and Fast Frequency Response Tests in a PSPP With Double-Fed Induction Machines	Alexander Jung	
		82	An Innovative Approach to PID Governor Upgrade for Reaching SFC Regulation Stability	Damir Dolenc	
		83	Transfer and Measurement of Power Plant Transients on a High-Performance Closed-Loop Test Rig	Christoph Geiger	
1300 – 1430	Lunch Break				Community Centre

Technical Session (TS4)

		Paper ID	Paper Title	Presenting Author	
1430 – 1630	Parallel Session Hydraulic Turbines **Session Chair:**	16	Parallel Performance Evaluation of the Island Model for Optimizing a Diffuser Augmented Kinetic Turbine	Alexander Tismer	APJA Kalam Block Room No. 103
		81	Numerical Investigation for Intake and Discharge Conditions of Horizontal Multi-Jet Pelton Turbines	Peter Mössinger	
		96	Multidisciplinary Optimization of an Axial Turbine	Alexander Tismer	

Time (hrs)	Session	Particulars			Venue
	Prof. Hemant Jibhau Sagar	98	Comparison of Discharge Characteristics of Pelton Injector Estimated by Empirical Relation, Numerical Simulation and Experiment	Sajan Shrestha	
		143	Broad Spectrum Quality Assessment of Flow Numerical Simulations in Pelton Turbine Runners	Martin Rentschler	
	Parallel Session CFD **Session Chair:** Prof. David Stefan	15	CFD Simulation of the Startup of a Pump-Turbine with Investigation of the Usage of a Porous Domain for Modelling Very Small Guide Vane Angles	Marco Zorn	APJA Kalam Block Room No. 104
		32	1D-3D Co-Simulation Pipe Resonance Induced by Cavitating Vortex Shedding	Sébastien Alligne	
		104	Large Eddy Simulation Analysis of Francis Turbine: A Comparison with Experimental Data and Investigation of Vortex Rope Dynamics in the Draft Tube	Soufiane Ramdani	
		126	Mitigation of High Load Flow Instabilities using Axial Water Jet Injection in Francis Turbines	Subodh Khullar	
		129	Numerical Study on the Optimal Design of Straight-Through Labyrinth Seals for Minimum Leakage Loss of Francis Turbine	Mamata Rijal	
		141	Computational Fluid Dynamics Based Transient Investigation of The Penstock in A Hydropower Plant	Firoz Khan	
	Parallel Session Multiphase Flow **Session Chair:** Prof. Hari Prasad Neopane	78	Pelton turbine needle eccentricity leading to asymmetric hydro-abrasive erosion	Navam Shrivastava	APJA Kalam Block Room No. 102
		119	Numerical Study of Sediment Erosion of a Francis Turbine with change in guide vane design	Rohit Kumar Sahu	
		146	Exploring the effects of operating time and sediment minerals on hydro abrasive erosion in Pelton turbine	Naman Arora	
		149	Numerical Analysis of Cavitation Characteristics of Francis Turbine at Different Runner Blade Numbers	Prashant Kumar	
1630 – 1700	Tea Break				APJA Kalam Block Lawn
1700 – 1830	**Technical Session (TS5)**				
		Paper ID	**Paper Title**	**Presenting Author**	
	Parallel Session Hydraulic Turbines **Session Chair:** Prof. Dhiman Chatterjee	120	Combined Water and Air Injection in Francis Turbine Draft Tube	Sandeep Kumar	APJA Kalam Block Room No. 102
		123	Design of Guide Vane Cascade Test Rig and Numerical Analysis of Flow Field	Rohit Kumar Sahu	
		142	Experimental Investigations of Sediment Erosion in Guide Vanes of Francis Turbine	Ravi Poudel	
	Parallel Session Pump Turbines **Session Chair:** Dr. Vlad Hasmatuchi	2	Behaviour Of Cavitation Characteristics for Different Vane Leading Edge Profiles of Radial Flow Pump Impeller	Christopher Stephen	APJA Kalam Block Room No. 103
		97	Estimate of the Radial Unsteady Forces Acting on a Cavitating Inducers from Casing Pressure Measurements	Eddy Terrasse	
		113	Preliminary Design of Adjustable Guide Vanes for PaTs in Pumped Storage Applications	Domenico Filannino	
	Parallel Session Vortex Breakdown **Session Chair:** Prof. C S Pant	30	A Parametric Study of Axial Flow Jets for Mitigation of Vortex Rope Instabilities	Hakan Nilsson	APJA Kalam Block Room No. 104
		35	CFD Simulation and Validation of a Load Rejection Procedure in a High Head Francis Turbine using Openfoam Software	Faiz Azhar Masoodi	
		135	The Influence of The Free Runners on the Decelerated Swirling Flow from the Draft Tube Cone of Hydraulic Turbines.	Alin Bosioc	

Day 3: Sept. 13, 2024 (Friday)

Time (hrs)	Session	Particulars	Venue
0900 – 1030	Plenary Session-3 (PS3) **Session Chair:** Prof. Hakan Nilsson	**Keynote Speaker:** Prof. Pavel Rudolf, Brno University of Technology, Czech Republic **Topic:** Exploring Cavitation in Swirling Flows: Insights from Experiments and Simulations **Address by Kirloskar Brothers Ltd.** **Address by Flovel Energy Pvt. Ltd.**	APJA Kalam Block Room No. 103
1030 – 1100	High Tea		APJA Kalam Block Lawn

Technical Session (TS6)

		Paper ID	Paper Title	Presenting Author	
1100 – 1300	Parallel Session Hydraulic Turbines **Session Chair:** Mr. Bernd Nennemann	24	Numerical Study of Nozzle Erosion and its Cascading Impact on Jet Quality	Arun Pandey	APJA Kalam Block Room No. 103
		93	Innovative Approaches to Hydraulic Turbine Advanced Condition Monitoring	David Valentin	
		127	Experimental and Numerical Investigation of Hydraulic Axial Thrust Fluctuation due to Draft Tube Vortex at Partial Load on Francis Turbine	Yuta Tamura	
		150	Empirical Relationship with Experimental Model Test Results on Change of Blade Number of Kaplan Turbine on Flow and Efficiency Characteristics	Mukesh Mangla	
	Parallel Session Recent Measurement Techniques **Session Chair:** Prof. Anant K. Rai	60	Developing a Customized Laboratory Setup to Assess Sensors for Real-Time Suspended Sediment Monitoring	Carolin Friz	APJA Kalam Block Room No. 102
		148	Measuring Mode Shapes of Kaplan Runners Using Optical Sensors Placed on the Stationary Frame	Greco Alonso Moraga González	
		10	CFD - Tool for Choosing a Suitable Flow Measurement Methods	Petr Nowak	
	Parallel Session Multiphase Flows **Session Chair:** Mr. Florian von Locquenghien	37	A Computational Study Using a Hybrid RANS-LES Turbulence Model for Cavitation Analysis in a High-Pressure Francis Turbine Guide Vane	Pallav Sahu	APJA Kalam Block Room No. 104
		67	Streamline Rotodynamic Pump Model for Two-Phases Flow Simulations	Simon Martel	
		6	On the Generation of Vortical Flow Structures in Pipes with Multifurcations	Bernhard Semlitsch	
1300 – 1430	Lunch Break				Community Centre

Technical Session (TS7)

		Paper ID	Paper Title	Presenting Author	
	Parallel Session Hydraulic Turbines **Session Chair:** Dr.-Ing. Alexander Tismer	147	Diagnosis of the Unstable Behaviour of a Kaplan Turbine Before Synchronizing to the Grid	Alexander Presas	APJA Kalam Block Room No. 103
		54	Influence of Cavitation Simulation on Pelton Turbine Bucket Performance	Xiao Yexiang	
		99	Analysis of the Flow Interference on a Pelton Turbine at Different Operating Heads	Xiao Yexiang	
	Parallel Session General Topics	59	Assessment of the Distributor Layout Influence on the Vortical Flow Within the Hydraulic Turbine	David Stefan	APJA Kalam Block Room No. 104
		76	Assessment of Synergistic Cavitation and Silt Erosion Performance of Hydroturbine Steel	Durga Pechetti	

Time (hrs)	Session	Particulars			Venue
1430 – 1630	**Session Chair:** Prof. Sailesh Chitrakar	87	Onsite Performance Testing of Archimedes Hydropower Screw for Low Head and Ultra-Low Head Hydro Power Project– A Case Study	Deepak S Pillai	
		121	Impact of Aerofoil Shapes on the Performance of Darrieus Vertical Axis Turbines: A Computational Study for Offshore Wind and Hydro Applications	Shubham Sharma	
1630 – 1700	Tea Break				APJA Kalam Block Lawn
1700 – 1830	Valedictory Session				APJA Kalam Block Room No. 103

Day 4: Sept. 14, 2024 (Saturday)

Time (hrs)	Particulars
0830 – 2000	Technical Tour to Pathri (1955) and Chilla (1982) Hydropower Stations, Pashulok Barrage, Ganga Aarti

For any assistance:

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Institute guest house Number:

NC Nigam	: Intra 6750 and from Mobile +91 1332 286750
KIH	: Intra 4100 and from Mobile +91 1332 284100
TOH	: Intra 4014 and from Mobile +91 1332 284014
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NOTES

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CAFÉ COFFEE DAY (CCD)
GROUND FLOOR MULTI ACTIVITY CENTRE (MAC), IIT ROORKEE

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HARIDWAR ROAD

RUSTIC HOUSE (WITH BAR)
NEAR GATE NO. 5

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