7th International Symposium on Hydraulic Structures

Aachen, Germany, 15 – 18 May 2018

Proudly supported by:

Handbook

Useful information to get the most out of ISHS 2018

version 1.1 (May 2018)

Table of Contents

Letter from the Chair

Hydraulic engineering is one of the most challenging fields in civil engineering and becomes more and more important in times of climate and demographic change. Particularly, the flow around structures is of a complex nature and flow phenomena are still not fully understood. This symposium aims to bring together experts working in the specialized field of hydraulic structure design from both, research and practice communities. It will provide a forum for presentation and discussion of recent advances in knowledge as well as future needs.

The symposium is yet another event in a series of successful workshops and symposia organized by the IAHR Hydraulic Structures Committee during the last decade - e.g. ISHS2016 (Portland, USA), IJREWHS2016 (Lübeck, Germany), IWHS2015 (Coimbra, Portugal), ISHS2014 (Brisbane, Australia), IJREWHS2014 (Spa, Belgium), IWLPKW2013 (Paris, France), IWLHS2013 (Aachen, Germany), ISHS2012 (Porto, Portugal), and many more.

ISHS2018 originally received 146 abstracts from 32 different countries which, after final paper submission and a thorough peer-review process, resulted in 78 papers for inclusion in the Proceedings. The Proceedings of the Symposium are to be published online Open Access through Digital Commons (Utah State Library).

The surroundings of Aachen, venue of the 2018 edition, are characterized by a long tradition in hydraulic engineering being reflected in a large number of dams, weirs and other structures as well as a high density of consultancies and local water associations. The Local Organizing Committee is thus delighted to invite you to participate in the 7th International Symposium on Hydraulic Structures, taking place on May 15 to 18, 2018, in Aachen, Germany.

On behalf of the Local Organizing Committee,

Daniel B. Bung (LOC Chair)

Organization

The symposium is organized by Aachen University of Applied Sciences' (FH Aachen) Hydraulic Engineering Section (HES) and the Hydraulic Structures Committee of the International Association for Hydro-Environment Engineering and Research (IAHR).

Local Organizing Committee

Daniel B. Bung, *Aachen University of Applied Sciences, Germany (Chair)*

Mario Oertel, *Lübeck University of Applied Sciences, Germany (Vice-Chair)*

Sébastien Erpicum, *University of Liège, Belgium*

Daniel Valero, *Aachen University of Applied Sciences, Germany*

International Scientific Committee

Blake P. Tullis,
Utah State University, USA (Chair)

Daniel B. Bung,
Aachen University of Applied Sciences, Germany (Vice-Chair)

Markus Aufleger,
University of Innsbruck, Austria

Benoit Blancher,
EDF-CIH, France

Robert M. Boes,
ETH Zürich, Switzerland

Fabian Bombardelli,
University of California, USA

Didier Bousmar,
Service Public de Wallonie, Belgium

Rita F. de Carvalho,
University of Coimbra, Portugal

Oscar Castro-Orgaz,
University of Córdoba, Spain

Hubert Chanson,
The University of Queensland, Australia

Brian Crookston,
Schnabel Engineering, USA

Benjamin Dewals,
University of Liège, Belgium

Sébastien Erpicum,
University of Liège, Belgium

Stefan Felder,
University of New South Wales, Australia

Nils Goseberg,
Technical University of Braunschweig, Germany

Sherry Hunt,
USDA ARS, USA

Robert Janssen,
Bechtel Corporation, Australia

Arturo Marcano,
Andres Bello Catholic University, Venezuela

Jorge Matos,
IST Lisbon, Portugal

Tom de Mulder,
Ghent University, Belgium

Mario Oertel,
Lübeck University of Applied Sciences, Germany

Stefano Pagliara,
University of Pisa, Italy

Michele Palermo,
University of Pisa, Italy

Michael Pfister,
HES-SO HEIA-FR, Switzerland

Artur Radecki-Pawlik,
Cracow University of Technology, Poland

Peter Rutschmann,
Technical University Munich, Germany

Anton Schleiss,
EPF Lausanne, Switzerland

Andreas Schlenkhoff,
University of Wuppertal, Germany

Sandra Soarez-Frazão,
Université Catholique de Louvain, Belgium

Vallam Sundar,
Indian Institute of Technology Madras, India

Carsten Thorenz,
Federal Waterways Engineering and Research Institute (BAW), Germany

Youichi Yasuda,
Nihon University, Japan

Jinhai Zheng,
Hohai University, China

Reviewers

The ISHS 2018 organization is thankful to all the reviewers. Their efforts have significantly contributed to reaching the high scientific ISHS standards.

Blake P. Tullis		Daniel B. Bung
Antonio Amador	Markus Aufleger	Benoit Blancher
Robert M. Boes	Fabian Bombardelli	Duncan Borman
Didier Bousmar	José María Carrillo	Rita F. de Carvalho
Luís Castillo	Oscar Castro-Orgaz	Giovanni de Cesare
Hubert Chanson	Brian Crookston	Benjamin Dewals
Sébastien Erpicum	Stefan Felder	Helge Fuchs

Rafael García-Bartual	Nils Goseberg	Carlo Gualtieri
Sherry Hunt	Robert Janssen	Svenja Kemper
Matthias Kramer	Eric Lesleighter	Joseph H.W. Lee
Amparo López-Jiménez	Arturo Marcano	Jorge Matos
Tom de Mulder	Sean Mulligan	Frederic Murzyn
Ioan Nistor	Mario Oertel	Stefano Pagliara
Michele Palermo	Michael Pfister	Artur Radecki-Pawlik
Anton Schleiss	Andreas Schlenkhoff	Lukas Schmocker
Frank Seidel	Sandra Soarez-Frazao	Vallam Sundar
Carsten Thorenz	Peter Troch	Daniel Valero
Roman Weichert	Youichi Yasuda	Jinhai Zheng

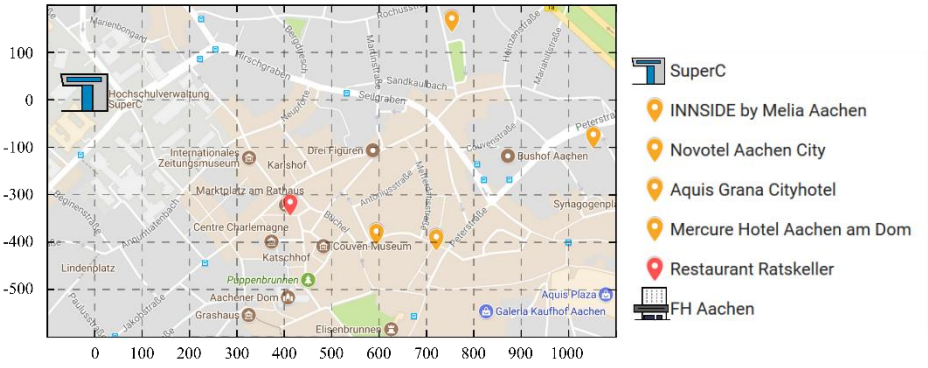
Venue

Being located close to the Belgian and Dutch border, Aachen is the most western major city in Germany. As an imperial city with 2,000 years of history, Aachen is a famous research place nowadays. It offers its inhabitants and, of course, the visitors as well, a broad range of cultural facilities, sporting activities, colourful festivals, interesting shopping and, naturally, a lot of green space for leisure in an international atmosphere.

Please keep in mind that temperatures in May range between 9 to 18 ºC with an average of 11 rainy days. Find more information about Aachen under www.aachen.de.

With more than 13,000 students, FH Aachen University of Applied Sciences is one of the biggest Universities of Applied Sciences in Germany. Being established in 1971 by consolidation of several older schools, education is based on a tradition of more than 100 years. Education and research focus on natural sciences and engineering, economics and design.

The Symposium and most of the pre-Symposium technical events will be held at the SuperC Congress Center, located at the North of the centre of Aachen. The Short Course on Basics Principles of Open Channel Hydraulics will be held at FH Aachen (Bayernallee 11).



Programme at a Glance

Monday, 14 May		Tuesday, 15 May		Wednesday, 16 May			Thursday, 17 May			Friday, 18 May	
FH Aachen Bayernallee 11		SuperC		SuperC	Generali Hall	Ford Hall	SuperC	Generali Hall	Ford Hall		
		08:00 - 09:00	Workshop registration	08:00 - 08:45	Registration						
				08:45 - 09:15	Opening address						
09:30 - 11:00	Short course	09:00 - 12:00	**Workshop on Nonlinear Weir Design** (overview and research outcomes)	09:15 - 10:00	**Keynote 1** (Paul Schweiger, P.E., CFM)		08:00 - 10:00	Technical session 7 **Sedimentation & Erosion** (6 papers with 15' + 4')	Technical session 8 **Intake Structures** (6 papers with 15' + 4')		
				10:00 - 10:30	Coffee break		10:00 - 10:30	Coffee break			
11:00 - 11:20	Coffee break			10:30 - 12:30	Technical session 1 **Dam Satefy and Management** (6 papers with 15' + 4')	Technical session 2 **Weirs & Spillways** (6 papers with 15' + 4')	10:30 - 11:15	**Keynote 3** (Prof. Dr. Andreas Schmidt)			
11:20 - 12:50	Short course						11:15 - 12:35	Technical session 9 **Waterway Structures** (4 papers with 15' + 4')	Technical session 10 **Physical Modelling** (4 paper with 15' + 4')		
12:50 - 13:30	Lunch break	12:00 - 13:00	Lunch break	12:30 - 13:30	Lunch break / Poster presentation		12:35 - 13:30	Lunch break / JHE Special Issue presentation		08:00 - 17:30	Field trip
13:30 - 15:00	Short course	13:00 - 16:00	**Workshop on Nonlinear Weir Design** (design considerations, applications and special features)	13:30 - 14:15	**Keynote 2** (Prof. Dr. Robert M. Boes)		13:30 - 15:10	Technical session 11 **Coastal Structures & Waves** (5 papers with 15' + 4')	Technical session 12 **Hybrid Modelling** (5 paper with 15' + 4')		
				14:15 - 15:35	Technical session 3 **Fish Passages 1** (4 papers with 15' + 4')	Technical session 4 **Case Studies** (4 papers with 15' + 4')					
15:00 - 15:20	Coffee break			15:35 - 16:00	Coffee break		15:10 - 15:40	Coffee break			
15:20 - 16:50	Short course	16:00 - 18:00	Registration	16:00 - 18:00	Technical session 5 **Fish Passages 2** (6 papers with 15' + 4')	Technical session 6 **Energy Disspators** (6 papers with 15' + 4')	15:40 - 17:40	Technical session 13 **Nonlinear Weirs** (6 papers with 15' + 4')	Technical session 14 **Numerical Modelling** (6 paper with 15' + 4')		
							17:40 - 18:00	Closing address			
		18:00 - 19:00	YPN night				18:00 - 19:30	Open HS Committee Meeting			
				18:30 - 20:00	Welcome reception		20:00 - 22:00	Dinner			

Legend

- Registration
- LOC address
- Break
- Reception/dinner
- Short course
- Workshop session
- Keynote
- Technical session
- IAHR Hydraulic Structures Committee Meeting
- Field trip

Pre-Symposium Technical Events

In addition to the main ISHS 2018 technical programme, a series of events are scheduled completing a full week of hydraulic engineering related activities.

Short Course: Basic Principles of Open Channel Hydraulics

Date: 14th May 2018
Location: FH Aachen, Bayernallee 11, 52066 Aachen
Instructor: Prof. Dr. Hubert Chanson
Starting/finishing times: 9:30 – 16:50
Registration: free of charge, under request at info@ishs2018.de

The course is an introduction to the hydraulics of open channel flows. The material is designed for undergraduate and postgraduate students in civil, environmental and hydraulic engineering, as well as young professionals and early-career researchers. It will be assumed that the participants have had an introductory course in fluid mechanics and that they are familiar with the basic principles of fluid mechanics: continuity, momentum, energy and Bernoulli principles.

The course will develop the basic principles of fluid mechanics with applications to open channels. Open channel flow calculations are more complicated than pipe flow calculations because the location of the free-surface is often unknown a priori (i.e. beforehand). An overview of the Workshop Program follows:

Short Course Program

1. Introduction to open channel flows
2. Basic principles of open channel flows
3. Application of the Bernoulli principle to open channel flows: short and smooth transitions
4. Application of the momentum principle to open channel flows: hydraulic jumps, flow resistance, uniform equilibrium flow
5. Gradually-varied steady open channel flow: hydraulic engineering of long channels and backwater calculations

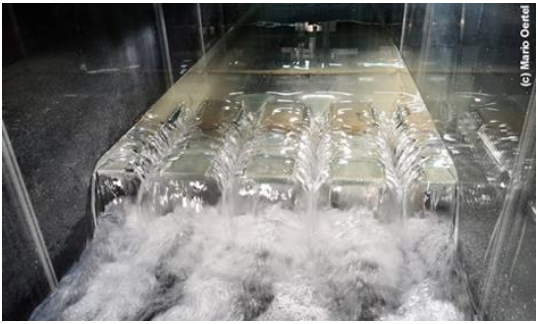
Bibliography
CHANSON, H. (2004). "The Hydraulics of Open Channel Flow: An Introduction." Butterworth-Heinemann, 2nd edition, Oxford, UK, 630 pages (ISBN 978 0 7506 5978 9).

Workshop on Nonlinear Weir Design: Theory and Practice

Date: 15th May 2018		
Location: 5th level of the SuperC Congress Center, Templergraben 57, 52062 Aachen		
Instructors: Prof. Dr. Blake P. Tullis, Dr. Sébastien Erpicum, Frédéric Laugier, Dr. Brian M. Crookston		
Starting/finishing times: 9:00 – 16:00		
Registration: mandatory		

Inadequate conveyance capacity, significant hydrologic loadings on embankments and structures, and operation and maintenance are common challenges and safety issues that often instigate the need for risk-reduction measures and/or rehabilitation. Labyrinth and piano key weirs are a particularly efficient approach to reduce these concerns. These weirs provide a crest length greater than the width of the channel and are commonly used in a variety of applications, including dam rehabilitation and new dam projects. In some cases, these structures may be complimentary to or even an alternative to gated spillways, which require operation and maintenance and can cause downstream flooding if misoperation or failure occur. Because of their hydraulic performance and site-adaptive geometries, these types of weirs are of increasing interest to those involved in water infrastructure, including practitioners, researchers, regulators, and owners. However, these types of weirs have complex geometries and hydraulic behaviours and can pose a challenge when developing an efficient design.

The workshop - organized by experts from research and practice - will cover all relevant stages of a labyrinth and a piano key weir project, from the first theoretical design to detailed studies and practical considerations related to the construction. The workshop will be divided in two parts, the first one presenting an overview on nonlinear weirs and the main research outcomes and the second one dedicated to design considerations, applications and special features. Several real examples in France and the USA will illustrate the technical presentations and time will be devoted to Q/A and discussion. An application exercise will be proposed to the workshop participants for both types of weirs. Comprehensive workshop material will be provided to all attendees.



Additional Events

Young Professionals Network (YPN) Night Tour

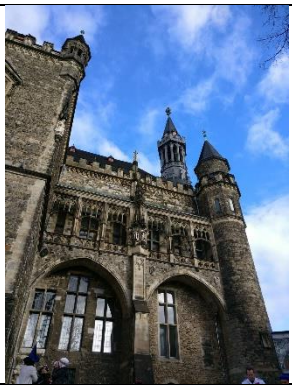
Date: 15th May 2018	
Meeting place: In front of the SuperC Congress Center, Templergraben 57, 52062 Aachen	
Convener: Daniel Valero	
Starting/finishing times: 18:00 – 19:00	
Registration: free, under request at valero@fh-aachen.de	

The Local Organizing Committee of the 7th International Symposium on Hydraulic Structures (ISHS 2018) is delighted to invite any Young Professional, Researcher and Engineer in the age range of 19 to 99 attending the Symposium to a short tour through the old town of Aachen and a beverage afterwards. The meeting point is in front (outside) of the SuperC Congress Center on 15th May at 18:00. Confirmation is not required but appreciated.

Welcome Reception

On Wednesday 16th at 18:30, the Local Organizing Committee invites you to attend the welcome reception which takes place at the conference venue.
Take the opportunity to chat with your peers in an informal environment. Drinks and finger food will be served.

Symposium Dinner

Date: 17th May 2018	
Location: Markt 40, 52062 Aachen	
Starting time: 20:00	
Registration: free for registered participants of the Symposium, required for accompanying persons (70 €)	

The ISHS 2018 dinner takes place in Ratskeller. With an open air welcome reception, starting at 20:00, ISHS 2018 attendees can enjoy the unique atmosphere of Aachen.

Field Trip

Date: 18th May 2018	
Meeting location for departure: Outside of the SuperC Congress Center, Templergraben 57, 52062 Aachen	
Starting time: 07:45	
Registration: free for registered participants of the Symposium, required for accompanying persons (30 €)	

The field trip includes the following three visits:

1. Eupen Dam (Belgium)

Eupen dam is located on the Vesdre river. The 66 m high gravity concrete damwas built between 1935 and 1949 to regulate the river discharge regarding needs of the manufactures in the downstream valley. Nowadays, the reservoir is used for drinking water storage and flood management.

The free surface spillway is made of 2 gates, a stepped spillway and a stilling basin, with a design capacity of 230 m^3/s.

2. Eupen water treatment plant

The Eupen water treatment plant is making water from the Eupen dam safe to drink since 1951. It has been refurbished in 2006, in particular to add a nanofiltration step. Together with the neighbour station of Stembert, Eupen plant has a nanofiltration capacity of around 110,000 m^3 per day, one of the largest in Europe.

3. Coo pump-storage plant (Belgium)

The Coo pump-storage plant was built between 1971 and 1979 to support the Tihange nuclear power plant located next to river Meuse. Its total power is 1,164 MW with 6 pump-turbine groups located in an underground cavern. Two upper reservoirs, with a storage capacity of 8.5 million m³, are located 279 m above the lower one. The plant is operated by ENGIE company and is a key component of the overall power production system in which intermittent renewable energy sources play a growing part.

After the visit of the cavern, a walk (5 km) along the Amblève river will provide a close look to Coo pump storage plant lower reservoir, Coo micro power plant and Coo waterfall.

The return to Aachen is scheduled to be after 17:30.

Detailed Technical Symposium Programme

Date: 16th – 17th May 2018	
Location: 6th level of the SuperC Congress Center	
Starting time: 8:00 – 18:00	
Registration: mandatory	
Please, upload the presentation as a *.zip file to the platform **prior to May 11th, 2018**	

Technical session information

The ISHS 2018 main event comprises to **3 keynotes and 14 technical sessions**. Keynote presentations are assigned 45 minutes. Each technical session is composed of a different number of oral presentations, all lasting 15 minutes with 4 additional minutes for public questions.

An additional **poster presentation session** will be held during the lunch break on 16th May. Presenters are kindly requested to be present during the second half of the lunch break. During the lunch break of 17th May, Prof. Thanos Papanicolaou will present the **Journal of Hydraulic Engineering (ASCE)** and a **special issue** based on the ISHS 2018 contributions.

Please **do not wait to upload your presentation immediately before your session begins**, as there will not be sufficient time to check functionality of content such as videos, etc. If you wish to upload a polished version onsite, we will have a presentation upload station at the registration desk. You must

upload any last-minute revised presentations no later than the day prior to your presentation so that we may transfer files to presentation laptops.

Philip H. Burgi Best Paper award

Given the 20th anniversary of the IAHR Hydraulic Structures Technical Committee, we are pleased to announce the inaugural **Philip H. Burgi Best Paper Award**, named after the first chair of our Technical Committee and sponsored by **Schnabel Engineering LLC**.


Philip H. Burgi

Sponsored by:

From all accepted manuscripts, 5 papers have been nominated by the LOC and ISC as finalists. The selection of the winning paper will be made by the ISHS 2018 audience based on the oral paper presentation. All participants of the symposium are invited to vote. The ballots are included in the conference bags and can be deposited in the Registration desk. Presentations of the finalists are marked below in the detailed programme (). The result will be announced during the congress dinner.

Open committee meeting

After the closing address on 17th May, an **open meeting of the IAHR Hydraulic Structures Committee** will be hosted. Anyone interested in the

past, present and future activities celebrated on behalf of the committee (such as ISHS 2018) are invited to participate.

Keynotes

Keynote Speaker #1: Paul Schweiger, P.E., CFM

Lessons-To-Be-Learned From Oroville Dam Spillway Incident

Date: 16th May 2018	
Location: Generali Hall	
Keynote speaker: Paul Schweiger, P.E., CFM	
Manager of the Dams and Hydraulics Section at Gannett Fleming, Inc.	
Starting/finishing times: 9:15 – 10:00	

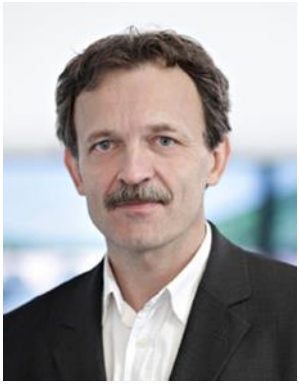
Keynote Speaker #2: Prof. Dr. Robert Boes

Multi-phase flows at hydraulic structures: water-sediment, air-water and water-structure-fish interaction

Date: 16th May 2018	
Location: Generali Hall	
Keynote speaker: Prof. Dr. Robert Boes	
Professor (full) at ETH Zürich Director of the Laboratory of Hydraulics, Hydrology and Glaciology (VAW)	
Starting/finishing times: 13:30 – 14:15	

Keynote Speaker #3: Prof. Dr. Andreas Schmidt

Modelling in Waterways Engineering - Expectations and Challenges

Date: 17th May 2018	
Location: Generali Hall	
Keynote speaker: Prof. Dr. Andreas Schmidt	
Head of the Department of Hydraulic Engineering at Federal Waterways Engineering and Research Institute (BAW)	
Starting/finishing times: 10:30 – 11:15	

ISHS 2018
First day: 16th May

Keynotes 1 & 2
Technical Sessions 1 – 6

Technical Session 1: Dam Safety & Management
Wednesday 16th May, Generali Hall
Chair: Prof. Dr. Anton Schleiss

10:30 10:50	S. L. Barfuss	Public Safety and Unauthorized Extreme Activities at Spillways
10:50 11:10	P. Furlan	Influence of density of large stems on the blocking probability at spillways
11:10 11:30	R. Pohl	Wave Deflectors to reduce the Run-up and Overtopping at Embankment Dams
11:30 11:50	S. V. De Simone	Data management system for dam monitoring of hydropower projects
11:50 12:10	R. Pohl	Dams beyond Design Assumptions
12:10 12:30	J. G. Dalfré Filho	The importance of erosion concrete tests for hydraulic surfaces

Technical Session 2: Weirs & Spillways
Wednesday 16th May, Ford Hall
Chair: Dr. Sherry Hunt

10:30 10:50	M. Kramer	Free-Surface Instabilities in High-Velocity Air-Water Flows down Stepped Chutes
10:50 11:10	D. Valero	Three-dimensional Flow Structure inside the Cavity of a Non-aerated Stepped Chute
11:10 11:30	A. Malcherek	300 Years 'De motu aquae mixto': What Poleni really wrote and a new Overflow Theory based on Momentum Balance
11:30 11:50	M. Lodomez	In-situ measurement and mitigation of nappe oscillations – The Papignies and Nisramont dams in Belgium
11:50 12:10	S. Erpicum	Experimental study of ogee crested weir operation above the design head and influence of the upstream quadrant geometry
12:10 12:30	O. J. Chesterton	Deterministic methods for testing block stability on masonry spillways

Technical Session 3: Fish Passages 1
Wednesday 16th May, Generali Hall
Chair: Prof. Dr. Blake Tullis

14:15 14:35	D. B. Bung	Hybrid Investigation on the Hydraulic Performance of a New Trapezoidal Fishway
14:35 14:55	M. Redeker	Design of Fish Pass Entrances - Considerations and Investigations
14:55 15:15	J. Klein	Influence of inflow and outflow boundary conditions on uniform flow in vertical slot fishways models
15:15 15:35	L. Cassan	Modeling of tide gate to improve fish passability

Technical Session 4: Case Studies
Wednesday 16th May, Ford Hall
Chair: Prof. Dr. Artur Radecki-Pawlik

14:15 14:35	L. Guiot	Fresh marsh network modeling for ecological continuity
14:35 14:55	Z. Ahmad	Physical Model Study of Spilling and Energy Dissipation Arrangements of Malana Dam, Kullu, India
14:55 15:15	M. Ebrahimi	Experimental investigation of scour and pressures on a single span arch bridge under inundation
15:15 15:35	L. R. Andersson	Inlet Blockage Effects in a Free Surface Channel with Artificially Generated Rough Walls

Technical Session 5: Fish Passages 2
Wednesday 16th May, Generali Hall
Chair: Prof. Dr. Stefano Pagliara

16:00 16:20	H. Chanson	Smart Baffles to Assist Upstream Culvert Passage of Small-Bodied Fish
16:20 16:40	S. Haufe	Hydraulic and Ecological Requirements for the Design of Stilling Basins at Flood Retention Basins with Ecological Passage
16:40 17:00	S. Kucukali	Flow and Turbulence Measurements in a Diagonal Brush Fish Pass: A Field Study
17:00 17:20	G. Fiedler	Design of auxiliary water systems for fishways
17:20 17:40	J. Vergeynst	Fish behaviour in the vicinity of a navigation lock complex: the challenges
17:40 18:00	S. S. Tfwala	Performance assessment of FLOW-3D and Xflow in the numerical modelling of fish-bone type fishway hydraulics

Technical Session 6: Energy Dissipators
Wednesday 16th May, Ford Hall
Chair: Dr. Michele Palermo

16:00 16:20	J. Deng	Ski Jump Hydraulics of Leak-Floor Flip Bucket
16:20 16:40	J. M. Carrillo	Characterization of two-phase flows in plunge pools
16:40 17:00	M. Gebhardt	Numerical and Physical Study on the Energy Dissipation at Inflatable Gates
17:00 17:20	D. Wüthrich	Behaviour of a scour protection overlay with randomly distributed concrete prisms in plunge pools downstream of mobile barrages for exceptional operation conditions
17:20 17:40	S. L. Hunt	Preliminary Results for Embankment Dam Stepped Spillway Stilling Basin Research
17:40 18:00	Z.-P. Niu	Study on optimization of flood discharge types in MHSJ stilling basin

ISHS 2018
Second day: 17th May

Keynote 3
Technical sessions 7 – 14

Hydraulic Structures Committee meeting
Symposium Dinner

Technical Session 7: Sedimentation & Erosion
Thursday 17th May, Generali Hall
Chair: Prof. Dr. Hubert Chanson

08:00 08:20	S. Pagliara	A preliminary study of field scour morphology downstream of block ramps located at river bends
08:20 08:40	M. Palermo	Scour Morphology Downstream of Log-Frame Deflectors in Series
08:40 09:00	F. A. Bombardelli	From developing to developed phase in the scour evolution due to vertical and sub-vertical plunging jets: New experiments and theory
09:00 09:20	T. Ohmoto	Effects of Weir with an Opening on Bed Morphology and Flow Patterns
09:20 09:40	A. Radecki-Pawlik	Numerical 2D simulation of morphological phenomena of a block ramp in Poniczanka stream: Polish Carpathians
09:40 10:00	T. Ohmoto	Effects of Dam Removal on Sediments and Flow Structures

Technical Session 8: Intake Structures
Thursday 17th May, Ford Hall
Chair: Dr. Sean Mulligan

08:00 08:20	J. M. Adriasola	Best practices for design of slurry flow distributions
08:20 08:40	S. N. Chan	3D CFD modeling of a Supercritical Bottom Rack Intake
08:40 09:00	L. Chang	3D Numerical Modeling of a Supercritical Intake with a Flow Diversion Barrier
09:00 09:20	S. Kemper	Numerical simulation of intake structures like street inlets with supercritical flow conditions
09:20 09:40	V. Naderi	A 3D study of an intake air-core vortex structure using PIV & flow visualization
09:40 10:00	V. Naderi	An experimental study of the performance of an ogee-shaped vertical intake: geometrical parameters of cross-vane vortex inhibitor

Technical Session 9: Waterway Structures
Thursday 17th May, Generali Hall
Chair: Dr. Carsten Thorenz

11:15 11:35	C. Savary	Butterfly valves - How to estimate cavitation level and related damages on existing locks and at the laboratory?
11:35 11:55	C. Swartenbroekx	Physical design of Upper Harbor at Auvelais Lock, Belgium
11:55 12:15	P. P. D. van der Ven	The Interaction of a Lock's Filling Jet and the Ship in the Lock Chamber, using Scale Model Measurements
12:15 12:35	K. Verelst	Comparison of software programs for computation of longitudinal forces on a ship in a lock chamber during levelling with openings in the lock gate

Technical Session 10: Physical Modelling
Thursday 17th May, Ford Hall
Chair: Prof. Dr. habil. Mario Oertel

11:15 11:35	L. Montano	LIDAR measurements of free-surface profiles and turbulent scales in a hydraulic jump
11:35 11:55	H. Chanson	Sediment Motion beneath Surges and Bores
11:55 12:15	Y. Bercovitz	Envelope trajectory of water jet issuing from a thin weir obtained by photogrammetry
12:15 12:35	D. A. Miranda	Experimental Study of the Influence of Inlet and Outlet Conditions on the Flow Pattern of a Rectangular Shallow Reservoir

Technical Session 11: Coastal Structures & Waves
Thursday 17th May, Generali Hall
Chair: Prof. Dr. Tom de Mulder

13:30 13:50	I. Martone	Experimental analysis on a low crested rubble mound breakwater
13:50 14:10	N. Mohd Anuar	Historical Storm Surges: Consequences on Coastal Resources and Shoreline Protection in East Coast of Peninsular Malaysia
14:10 14:30	B. Ayurzana	Application of a free surface immersed boundary-lattice Boltzmann modeling to wave forces acting on a breakwater
14:30 14:50	P. Troch	Design features of the upcoming Coastal and Ocean Basin in Ostend, Belgium, for coastal and offshore engineering applications
14:50 15:10	H. von Häfen	Lift and Swing Gate Modelling for Dam-break Generation with a Particle-Based Method

Technical Session 12: Hybrid Modelling
Thursday 17th May, Ford Hall
Chair: Dr. Sébastien Erpicum

13:30 13:50	M. Dufresne	A coupled approach between physical modeling and computational fluid dynamics to improving ecological continuity
13:50 14:10	H. Chanson	Air Bubble Entrainment in Breaking Bores: Physical and Numerical CFD Modelling
14:10 14:30	F. Jacobsen	Using Poisson Distribution to Compare CFD and Physical Modelling of Water Surface Levels for a High Speed Aerated Spillway
14:30 14:50	C. Torres	Determination of Scale Effects for a Scaled Physical Model of a Labyrinth Weir using CFD
14:50 15:10	G. Göbel	Numerical and Physical Study on Seal Vibrations at Hydraulic Gates

Technical Session 13: Nonlinear Weirs
Thursday 17th May, Generali Hall
Chair: Dr. Brian Crookston

16:00 16:20	M. Oertel	Piano Key Weir research: state-of-the-art and future challenges
16:20 16:40	F. L. Bremer	Mesh dependence for 3D CFD simulations to analyze Piano Key Weir discharge coefficients
16:40 17:00	J. Herbst	Sediment Transport over Labyrinth Weirs
17:00 17:20	B. P. Tullis	Size-Scale Effects of Labyrinth Weir Hydraulics
17:20 17:40	J. Merkel	Energy Dissipation Downstream of Labyrinth Weirs
17:40 18:00	F. J. M. Denys	Transient Hydrodynamics of Piano Key Weirs

Technical Session 14: Numerical Modelling
Thursday 17th May, Ford Hall
Chair: Prof. Dr. Fabian Bombardelli

16:00 16:20	S. Mulligan	Multiphase numerical modelling of hydraulic structures with rapidly rotating flows: Stormwater Vortex Hydrodynamic Separator
16:20 16:40	C. Thorenz	Numerical Study on the Hydraulic Conditions for Species Migrating Downstream over a Weir
16:40 17:00	A. de Loor	Determining flow velocities at damaged weir of Grave using CFD
17:00 17:20	C. J. O'Neill	Numerical simulation and assessment of the effects of inlet configuration on the flushing time of a potable water service reservoir
17:20 17:40	D. Calderón Villegas	CFD simulation of the air-water flow in the bottom outlet of Ituango hydroelectric project
17:40 18:00	L. David	Influence of macro-roughnesses on vertical slot fishways