

## Volume 1, Issue 3

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## 1. Introduction

The third issue of the IAHR Cardiff Young Professional Network (YPN) newsletter provides updates of events and activities carried out over the past few months. We are excited to announce that in the start of this new academic year of 2015/16, a fresh committee board of the IAHR Cardiff YPN has been formed, led by the newly-elected president, Luis Priegue.

The highlights of recent months covered within this newsletter include the 36th IAHR World Congress at Delft – The Hague, Netherlands, at which several HRC members presented their updated research works and helped with the organisation of special YPN sessions. The prestigious student paper competition, the JFK award, was won by Cardiff YPN's Pablo Ouro Barba. This fantastic achievement is detailed further in the newsletter, followed by an update on the progress of this research.

News of recent and future activities held by the YPN are also featured, including a YPN member's trip to Mexico, the second micro-presentation event, and planned events such as a special session on Welsh Tidal Energy Options and a third micro-presentation evening.

## 2. Message from IAHR Cardiff YPN President 2015/16

The Young Professional Network from Cardiff University had undertaken great activities in

previous years, but it is obvious that a whole new level has been achieved recently. I would like to highlight and thank the outstanding work from the 2014/15 IAHR Cardiff YPN committee. They were able to enhance the professional and social possibilities that this organization has always been offering. During the past year, the link between the HRC and CIWEM, Arup and CH2M has been significantly strengthened, and it is the intention to further extend the network and increase the collaboration between the members.

This quarterly newsletter has been a huge success. In this technological world where Internet and social media play key roles on the distribution of information, it has been proved that this publication is a fantastic tool to show the activities carried out by the group and also the work that YPN members produced.

In addition to that, in collaboration with the Chartered Institution of Water and Environmental Management Welsh Branch (CIWEM), the Cardiff YPN was able to coordinate two micro-presentation events. Research Associates, PhD students and YPN industrial partner members showed their research and projects in a five-minute "elevator pitch" presentation. This format allowed the participants to show their work to the scientific and industry audience with a brisk and dynamic style.

From a social point of view, the YPN has organized several events in order to encourage the interaction between members, including dinners and sport social evenings, which have been well attended by the members.

These and more activities have contributed to spreading the word about Cardiff YPN and also the strengthening of connection and ties between industry and academia. The current YPN committee members will try their best to continue the good work and improve on it where possible.

Finally, I would like to encourage, not just current and potential members of the YPN but also everyone that is interested, to take part in future projects and to get involved with the organization. This newsletter is expected to be read by our current networking partners for potential collaborations in both academia and industry. Please visit our website at <https://www.iahr.org/site/cms/contentviewarticle.asp?article=792> for further information.

Best regards,

Luis Priegue – President of the IAHR Cardiff YPN 2015/16

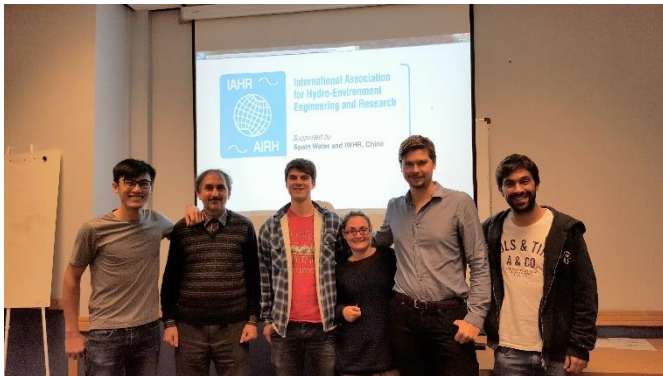


Figure 1: IAHR Cardiff YPN Committee 2015/16. From left: Ken Chua, Saad Mulahasan, Jonathan King, Elli Mitrou, Nejc Coz, Luis Priegue. Not in picture: Christopher Kiiza

## 3. Events

### 3.1 CIWEM Micro-presentation Round 2

Following on from the extremely successful micro-presentation event in 2014, for which the Cardiff YPN won the CIWEM Welsh Branch award for Best Presentation of the Year, a second event was held at the University in May 2015.

The format is a great way to get an overview of the broad range of water-related topics being worked on by the YPN members. In no longer than 5 minutes, the presenter must get across the main messages about his or her work; certainly a challenge given the complexity of the industrial and research projects of the group.

The 5-minute timeslot allowed for no more than a quick introduction to the problem, an outline to the solution, results to-date and plans for the future. This is an increasingly popular presentation-style (the 'Elevator Pitch'), as it gives the opportunity for many presentations in a single event, and ensures that each presentation is concise, to the point, and hence invariably fast-paced and absorbing.



Figure 2: CIWEM Micro-presentation Round 2. Event booklet in picture.

At the first round of the micro-presentation event, the speakers were all members of Cardiff University's HRC, so it was great to be able to include our industry partners in this second round, with presentations from Arup's Candice Constantine, Nick Copeland and Ellis Blackmore.

Thanks again to CIWEM for their continued collaboration and help with organising these excellent events. The new Cardiff IAHR YPN committee is currently in the process of arranging a third micro-presentation event, and will circulate further details as soon as they become available.

### 3.2 IAHR World Congress

The biennial IAHR World Congress was held in The Hague from the 27th of June to the 3rd of July 2015, an event extensively attended by members of the Cardiff IAHR YPN. The 36th IAHR World Congress brings together researchers and practitioners in the field of Hydro-environmental Engineering and Research with a view to present upon recent developments as well as foster collaborations among research efforts on an international level. The focus of the Congress relates to several key themes such as the Hydro-environment, Water Engineering, Flood Risk Management, Marine Renewable Energy, Extreme events and Climate Change, Water Resources and Hydroinformatics.

There was a very strong representation from members of our Network ranging in topics ranging from bubble plumes (Dr. Bruño Fraga Bugallo), Free-surface flow bed friction (Dr. Richard McSherry), Tidal Stream Devices (Pablo Ouro Barba/ Luis Priegue), Sediment Transport (Yan Liu) to Water Treatment and Tidal Range Technologies (Dr. Athanasios Angeloudis). All presentations were

very well received by the audience and led to lively discussions during the sessions as well as at the forum afterwards. Particular highlights include the awards presented to Pablo Ouro Barba and Prof. Thorsten Stoesser in recognition of their outstanding contributions in the field.

In general, the Congress was very successful and provided an overview and the developments towards addressing some key challenges within hydraulic research. The next Congress will be held on the 14-18<sup>th</sup> August 2017 in Kuala Lumpur – Malaysia, an event that promises to be as enlightening as the previous one.



Figure 3: Photo of IAHR Cardiff YPN Members with Prof. Thorsten Stoesser (4<sup>th</sup> from left) in the 36<sup>th</sup> IAHR World Congress

### 3.3 Cardiff YPN on the Young Professionals' Programme in the IAHR World Congress

A total of eight Cardiff YPN members attended the IAHR World Congress. Besides their participation in the research programme, our members also collaborated in a multitude of activities oriented to young professionals together with Networks from many different countries.

**YPN Corner:** there was a physical space within the venue allocated specifically as a meeting point for YPN members and daily activities. A presentation with basic information on all the Networks and their most recent activities was always on display here. Cardiff YPN was present at the YPN Corner and our members had the opportunity to join the speed networking and scientific publishing workshops.

**YPN Forum:** the Forum was a great opportunity to share our visions on the future of the YPN's in a very participative environment. This event had two parts. Firstly, representatives of the IAHR and four Networks gave a little speech on their particular realities and ideas for the future. Then, there was a very interesting colloquium between the participants and the audience on the most relevant topics discussed during the previous part, namely the role of the YPN's within their institutions or how to successfully promote the participation of members of Industry and Academia together. It was truly interesting to see the different approaches and activities developed by the groups at Cardiff (UK), Murcia (Spain), Stuttgart (Germany) and Delft (Netherlands). Bruño Fraga, vice-president of Cardiff YPN was our representative speaker in the Forum.

**YPN Tour and Dinner:** a technical tour to Maeslantkering, Sand Engine and Port of Rotterdam was scheduled for students and young professionals. Following this unique opportunity we had the opportunity of enjoying a social gathering and dinner in a boat.

**John F. Kennedy Student Paper Competition:** this prize acknowledges outstanding research carried out by students and lone authors. Cardiff YPN was really proud that one of us was the winner!



Figure 4: Cardiff YPN representative speaker in the YPN forum, Bruño Fraga

The Cardiff YPN would like to acknowledge Delft YPN for their great effort made hosting, planning and organising all these activities, as well as saluting all the other YPN's around the world in participating and collaborating with us, making these events successful and an unforgettable experience.



### 3.4 John F. Kennedy award

During the 36th IAHR World Congress at The Hague, the 12th edition of the John F. Kennedy Student Paper Competition was celebrated. To take part in this competition, students had to submit a written paper which was going to be evaluated by the jury in addition to the oral presentation given at the venue. From a total of 45 students who signed up to participate, the committee short-listed the best 9 student papers whose oral presentation were going to be evaluated. The winners were going to be chosen by averaging both written paper and oral presentation.

From our Cardiff YPN, Pablo Ouro Barba was the only student to take part of this competition. He presented his work entitled “Large-eddy simulation of vertical axis tidal turbines: study of the blockage effect”, where the performance of a tidal turbine under different blockage scenarios was studied.

The winners were announced during the closing ceremony at the end of the conference. After a hard decision from the judges, Pablo was one of the two winners!! We would like to congratulate him and David Ferras from the University of Lisboa for winning this prestigious prize.



Figure 5: Pablo Ouro Barba receiving the JFK prize at the 36th IAHR World Congress

Pablo would like to specially thank the Kennedy family to keep this student competition at every IAHR World Congress edition, in memory of the remarkable work and contribution to the world of hydraulics by Professor John F. Kennedy. The JFK prize is one of the most prestigious awards for PhD students in hydraulics and it is an honour to have

participated. Thank you very much to Nancy and Suzanne Kennedy for all this.

## 4. Research progress

### Large-Eddy Simulation of tidal turbines, by Pablo Ouro Barba

There is an increasing interest in harnessing energy from tides to satisfy the growing demand for clean energy. The fact that tides can be 100% predictable makes tidal energy an attractive and promising alternative to fossil based fuel and other renewable energy sources. Wales has become a hotspot in the tidal energy technology development, specially boosted by the fact that the Severn channel is considered the second largest tidal range in the world.

The wind industry has been developing turbines for many years and the technology is mature and developed. Though tidal turbines can import technology from the wind industry, important changes have to be done, especially regarding the loads induced by the water that are much larger than the ones from wind due to the density difference.

Under the supervision of Professor Thorsten Stoesser, this research is focused on the numerical simulation of both vertical and horizontal axis tidal turbines. Using the in-house Hydro3D code (please visit: <http://hydro3dproject.github.io/> for more details), the author developed an algorithm using the immersed boundary method to simulate operating turbines. This algorithm is based on an Eulerian-Lagrangian formulation, where the Eulerian fluid is solved in a fixed Cartesian grid and the Lagrangian solid is described by moving discrete markers that represent the turbine's shape. The main advantage of this scheme is the ability to perform large eddy simulation without re-meshing the Eulerian mesh at every time step and also use fast Poisson equation solvers. Hydro3D features a hybrid parallelization with MPI and OpenMP in both the fluid and solid frameworks, which allows the speeding up of simulations which run in the Raven supercomputer of the Advance Research computing at Cardiff University (ARCCA).

In the School of Engineering at Cardiff University the author's colleague Luis Priegue tested in the hydraulics flume several tidal turbine prototypes.

The goal of this numerical study is to reproduce the experimental test results by matching the experimental efficiency, understanding the complex physics in the flow around the turbine and assessing possible design improvements to increase turbine efficiency and survivability. Currently, the model is at the experimental-numerical validation stage for vertical axis (Figure 6) and horizontal axis (Figure 7) tidal turbines. Once this stage is completed, further improvements in the current designs in terms of blade shape, spoke shape, etc. will be carried out, together with the study of the interaction of arrays of turbines and analysis of the fluid-structure interaction of the entire system.

This research is funded by the EPSRC to whom the author is very thankful for supporting his research. For more information about this project, please contact: Pablo Ouro Barba, [ourobap@cardiff.ac.uk](mailto:ourobap@cardiff.ac.uk).

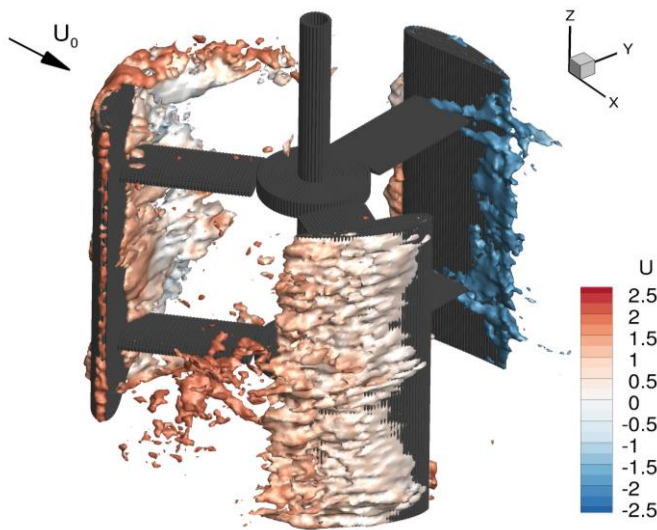


Figure 6: Numerical simulation of a vertical axis tidal turbine prototype rotating at Tip Speed Ratio = 2. Iso-surfaces of velocity magnitude are plotted.

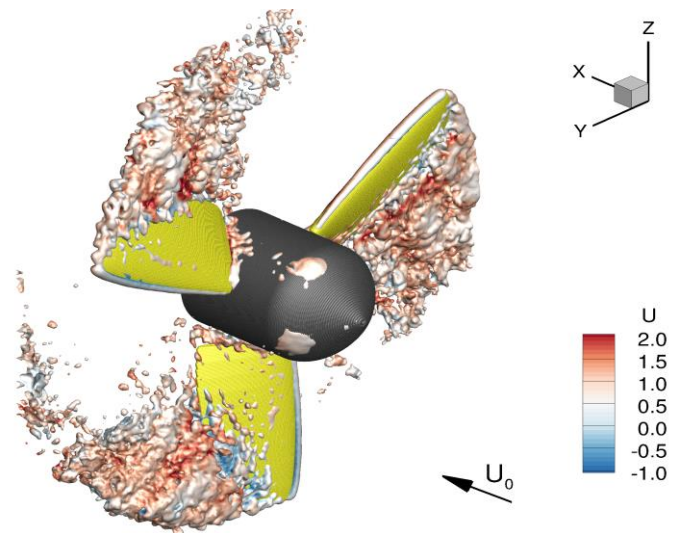


Figure 7: Numerical simulation of a horizontal axis tidal turbine rotating at Tip Speed Ratio = 5. Iso-surfaces of  $Q$ -criterion = 100 are plotted.

## 5. Recent activities

### Cardiff University International Experience Fund, by Fernando Alvarez-Martinez

Cardiff University offers to their PhD students the possibility to travel abroad to other Universities in order to complete their skill set by taking advantage of laboratories or equipment that is not available at Cardiff University. I got awarded with the International Experience Fund and travelled to the Cinvestav (Center for Research and Advanced Studies of the National Polytechnic Institute) in Merida, Mexico, invited by Dr. Ismael Mariño Tapia.

The Cinvestav is a Mexican Research Institution associated to the National Polytechnic Institute. The Cinvestav has 28 research departments that are distributed by the 10 research centres located throughout Mexico. The department I visited, Ocean Resources, is the one located in Mérida, in the Yucatán Península.

The outcome of this experience exceeded my expectations as I was involved in different field trips with different teams and equipment. Dr. Ismael Mariño planned a series of field trips where I could be involved as part of the team, working with different piece of equipment and in different environments. The local team, especially their technician, Manuel Uc, was very supportive and explained to me how all the used equipment worked at every step of the process.



During my stay at the Cinvestav, I had the opportunity to join four different field trips. This was a unique opportunity to get to know different devices related to coastal surveying. The first trip consisted of using a differential GPS on the Telchac Puerto lagoon to take elevation measurements for a PhD student. Apart from the nearly 40 Celsius I walked over the mud lands to take some of the measurements below the water level.

The second trip involved the use of a new shallow water multi-beam device. As it was the very first time it was used at Cinvestav since it was purchased, this trip had the objective of checking everything was working and the mounting structure was properly designed. This time, the team was taking measurements in a well-controlled environment inside Telchac Puerto harbour.



Figure 8: GPS base-unit installation

The third trip required a recovering of a velocimeter and ecosonda located 9km off the shore of Telchac Puerto. Part of the team used their diving skills to go underwater to reach the 8m deep seabed to recover the device and install a new one in the same location. The final trip was to Telchac Puerto beach to recover an in-house designed sand trap installed by other team two days before. This sand trap will allow the team to reduce the cost of buying a commercial device and also will provide the ability to adapt the equipment to their needs.

As a result, I developed my understanding on field campaign organisation, from the initial need of data, to the equipment selection, equipment organisation and issues related to field campaign activities. This knowledge allows me to better understand the data

I am working with in my PhD. Moreover, I got to know about the research carried out in the Cinvestav by working with different researchers and students as well as to share my own research experiences and listen to different research perspectives. Also, the possibility of publishing a joint paper arose and we are currently working on this opportunity.



Figure 9: Setting up the shallow water multi-beam.

## 6. Future activities

### 6.1 Welsh Tidal Energy Options and Challenges, organised by CIWEM Welsh Branch

An evening presentation event on the topic related to tidal energy in Wales will be held on the 25<sup>th</sup> November 2015 at the Faculty Lecture Theatre, Trevithick Building, Cardiff University. The invited guest speakers are Dr. Paul Evans from Intertek, Sam Bray, and Dr Athanasios Angeloudis, both from the HRC, Cardiff University. This is a free event which welcome all interested public members to join. Details of the event can be found in this link. <http://www.ciwem.org/events/events-calendar/2015/nov/25/welsh-tidal-energy-options--challenges.aspx>

### 6.2 Social events

Our biweekly badminton social sessions are still going on with increasing participants every time. A badminton tournament was successfully held recently in October, motivating members to play well while having fun.

The YPN committee is in the process of organising meeting with the industrial partners for a drink, giving chances for both sides to build up good relationships, leading to better meaningful collaboration in the future. Also, it encourages the people from industry to join the Cardiff YPN.

The annual Christmas dinner of the HRC group is currently being organised by the YPN committee. It has always been a well-received event over the years. The IAHR YPN committee members hope it will be as successful as always and wishes everyone an early Merry Christmas and a Happy New Year.



Figure 10: Badminton Social - October 2015

## 7. Publications

Some of the publications of the HRC members since the last newsletter issue are:

1. Evans P, Mason-Jones A, Wilson C.A.M.E, Wooldridge C, O'Doherty T, O'Doherty D. (2015). Constraints on Extractable Power from Energetic Tidal Straits. *Journal of Renewable Energy*. Volume 81: 707-722. [10.1016/j.renene.2015.03.085](https://doi.org/10.1016/j.renene.2015.03.085)
2. Fraga B, Stoesser T, Lai C.K and Socolofsky S. (2015). A LES-based Eulerian-Lagrangian approach to predict the dynamics of bubble plumes. *Ocean Modelling*. [10.1016/j.ocemod.2015.11.005](https://doi.org/10.1016/j.ocemod.2015.11.005)
3. Kara S, Stoesser T, Sturm T.W and Mulahasan S. (2015) 'Flow dynamics through a submerged bridge opening with overtopping', *Journal of Hydraulic Research*, 53(2), 186-195. [www.psfvip10.unina.it/Ebook/web/papers/025\\_PSFVIP10](http://www.psfvip10.unina.it/Ebook/web/papers/025_PSFVIP10)

4. Mulahasan S, Stoesser T and Alvarez F. (2015) 'Visualization of shear layers in compound channel flows', 10th Pacific Symposium on Flow Visualization and Image Processing Naples, Italy, 15-18 June, Paper ID: 25. [10.1080/00221686.2014.967821](https://doi.org/10.1080/00221686.2014.967821)
5. Ouro P, Cea L, Ramirez L, Nogueira X. An immersed boundary method for unstructured meshes in depth averaged shallow water models. Accepted in *International Journal for Numerical Methods in Fluids*. [10.1002/flid.4201](https://doi.org/10.1002/flid.4201)
6. Whittaker P, Wilson C.A.M.E., Aberle J. (2015). An improved Cauchy number approach for predicting the drag and reconfiguration of flexible vegetation. *Advances in Water Resources* 83: 28-35. [10.1016/j.advwatres.2015.05.005](https://doi.org/10.1016/j.advwatres.2015.05.005)

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