AUGUST 2020

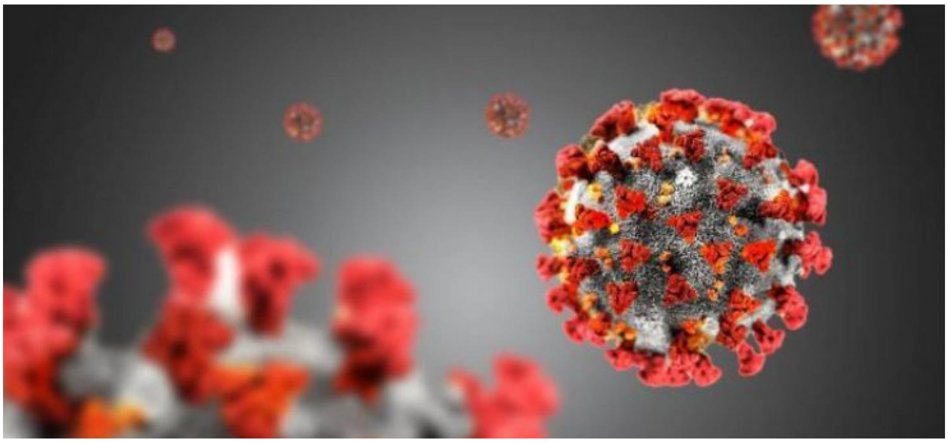
SPHERIC

NEWSLETTER

30th issue

SPH rEsearch and engineeRing International Community

SUMMARY



SPH in the time of COVID-19

Benedict D. Rogers
The University of Manchester, United Kingdom

To all SPHERIC Members,

I hope this SPHERIC newsletter finds you well. COVID-19 has presented the world with an unprecedented crisis that has both exposed the frailties of our existence and shown us all new ways of operating. All of us have been affected. Within SPHERIC, the crisis meant that the first international SPHERIC workshop planned to take place in the US has been postponed until June 2021. We sincerely thank Dr Angelo Tafuni (NJIT) for his dedication and agreeing to repeat all of his earlier work in organising the workshop a year later. With hindsight, we were fortunate to hold at least one SPHERIC Workshop in 2020 in January with the 2020 SPHERIC Harbin International Workshop in China, organised by Prof. A-Man Zhang of Harbin Engineering University (HEU). This was a fantastic event (reaching an outside temperature of -22 degrees C) hosted magnificently by Prof. Zhang and his team with over 140 delegates! Please read the report in this newsletter.

As the disruption from COVID-19 continues, it is at challenging moments like this, that it is important to continue to connect as a community. Indeed, one of the elements I enjoy most about SPHERIC is the conversations, discussions and friendships that grow from our events. SPH activity has some advantages in that SPH research can continue by remote working, so I hope you are all continuing to make progress with SPH. In many research groups around the world we have continued to meet weekly with our SPH group meetings continuing as strong as ever, and I encourage you to engage in similar activities. To help keep the community together, the SPHERIC Steering Committee will be starting a series of community initiatives, so watch out for future announcements!

In the meantime, please try to think of as many ways that SPH can be used to tackle the COVID-19 crisis.

Take care and stay safe.

2020 SPHERIC Harbin International Workshop

Prof. A-Man Zhang

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Harbin Engineering University

Harbin International Ice and Snow Sculpture Festival

Prof. Benedict Rogers and Prof. A-Man Zhang

The 2020 SPHERIC Harbin International Workshop (i.e. SPHERIC Harbin 2020) was organized by Harbin Engineering University during January 14-16, 2020. This is the second time that the SPHERIC Workshop was held beyond Europe. The SPHERIC Harbin 2020 took place in the Jingu Hotel, located at the Harbin Central Street, close to the Songhua River which was totally frozen during winter and surrounded by many ice and snow sculptures and activities.

The SPHERIC Harbin 2020 organization committee received abstracts from China, Italy, France, UK, Germany, Spain, Ireland, Japan, etc. 52 abstracts were selected to present in the workshop. The topics of the selected papers ranges from theoretical and numerical aspects of SPH and other particle-based methods to their applications in hydrodynamics, solid mechanics, fluid-structure interactions, high performance computing and industrial applications for coastal, ocean and civil engineering problems.

More than 140 delegates attended this workshop which was preceded by a training day (January 13, 2020) attended by about 45 participants. The training day included three lectures and a hands-on practice session using the SPH-Flow software. In the morning session, Dr. Guillaume Oger from Ecole Centrale de Nantes, France and Prof. Abbas Khayyer from Kyoto University, Japan gave two lectures on Fundamentals of SPH and Fundamental Theories of Particle Methods for Incompressible Fluids, Elastic Structures and their Interactions, respectively. The afternoon session was started with a lecture by Dr. Matteo Antuono (CNR-INM, Institute of Marine engineering, Rome, Italy), Dr. Salvatore Marrone (CNR-INM, Institute of Marine engineering, Rome, Italy) and Dr. PengNan Sun (LHEEA Lab., Ecole Centrale de Nantes, France). The Development of delta-SPH, delta+-SPH and deltaALE-SPH models and their applications were introduced in de-

Mr. Zifei Meng awarded of the Best Student Paper Prize by Prof. Ben Rogers

Miss Yijie Sun awarded of the Exellent Student Paper Prize by Prof. David Le Touzé

Mr. Pablo Eleazar Merino Alonso awarded of the Outstanding Student Paper Prize) by Prof. Moubin Liu.

tail. After that, Dr. Guillaume Oger and Prof. David Le Touzé from LHEEA Lab. of Ecole Centrale de Nantes organized the hands-on practice session. The SPH-flow software developed by the Next-flow Company in Nantes, France was installed on desk machines and the participants were guided to conduct SPH simulations with adaptive particle refinements (APR).

14 workshop sessions with excellent presentations covering a variety of SPH research and applications were arranged over the three days (January 14 to 16, 2020). Three 45-minute keynote lectures were given on the mornings of the three days. Prof. Xiong Zhang from Tsinghua University, China presented the keynote lecture with the title “Our Recent Developments on Material Point Method for Modeling Extreme Deformation Problems”. Prof. Abbas Khayyer from the Kyoto University, Japan presented the second keynote lecture with the title “Projection Particle Methods - From Fluids to Hydroelastic FSI - Recent Advances and Future Perspectives”. Prof. Fei Xu (Dr. Yang Yang helped to present) from Northwestern Polytechnical University, China presented the last keynote lecture with the title “Improved SPH and its Applications in the Field of Aeronautics”.

A short visit tour to the Zhaolin Part with beautiful ice lanterns was organized after the last session on the second day. After the tour follows the banquet held at the Gingu Hotel. During the banquet, four Chinese-style artistic shows were performed. The highlight was the awarding of the student prizes which went to Mr. Zifei Meng (Best Student Paper Prize) from Harbin Engineering University, China, Mr. Pablo Eleazar Merino Alonso (Outstanding Student Paper Prize) from Universidad Politécnica de Madrid, Spain and Miss Yijie Sun (Excellent Student Paper Prize) from Xi’an Jiaotong University, China. A short presentation was given by Dr. Yang Yang from Northwestern Polytechnical University to announce the 2022 SPHERIC International Workshop in Xi’an, China.

The SPHERIC Harbin 2020 was financially supported by the National Natural Science Foundation of China (NSFC), the Heilongjiang Touyan Innovation Team Program, and Harbin Engineering University. We are grateful to Prof. Benedict Rogers for his great support during the preparation of the workshop and we appreciate the constructive suggestions from the SPHERIC steering committee. We also thank the Executive Editor-in-Chief, Dr. Liandi Zhou of Journal of Hydrodynamics (JHD) in which 5 selected high-quality papers from the workshop proceeding will be published in a Special Column.

Steering Committee meeting taking place during the 2020 SPHERIC Harbin international workshop

Multi-resolution Method for Fluid-solid Interaction Problem

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Multi-resolution techniques in particle methods, such as the initial particle refinement, adaptive particle refinement, overlapping particle technique [1], and particle splitting/merging algorithms [2], have been developed to increase calculation accuracy and efficiency. The main challenge of the splitting/coalescing technique is the sharp change in particle distribution (or size) due to particle addition/removal, which would lead to numerical instability. In this study, the splitting/coalescing process is improved by a proposed smoothing scheme, called variable size particle (VSP). The features of this algorithm are:

1) Particles split/coalesce gradually in five steps, which is different from the conventional one step process. The size and position of particles are changed more smoothly to avoid overlapping or clustering, which are the potential causes often leading to mis-convergence.

2) A regional particle size range, instead of single size, is prescribed in every resolution domain. Multiple particle sizes are the key for the system conservation.

3) Particle splitting/coalescing happens in the whole computational domain, not only on the interface between refined and de-refined domains.

A chain reaction in which neighboring particles coalesce just after splitting, and then split again, would increase splitting/coalescing times, and decrease calculation efficiency. To avoid the chain reaction, an variable particle size pair splitting technique is proposed. A mother particle splits into two daughter particles with different sizes, and particle sizes are changing gradually in five steps, as shown in Figure 1.

Another challenge in coalescing is that when several neighboring particles merge at the same time, there will be gaps among the newly generated particles. It would make a significant decrease of particle number density. A five-step variable particle size pair coalescing technique is proposed, and the conservation of mass and momentum are strictly ensured.

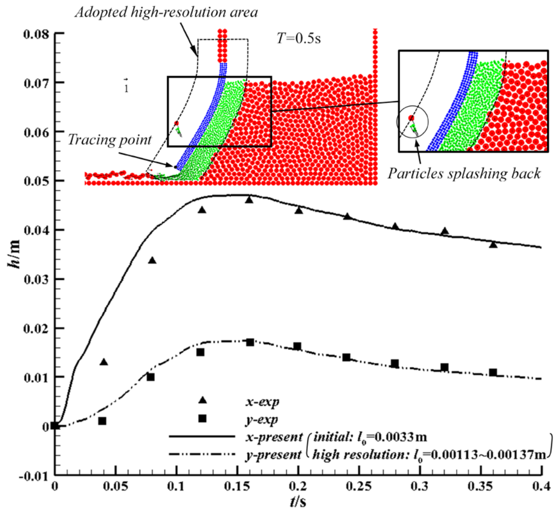

Figure 2. Comparison between experiment and numerical results of elastic gate case

The VSP algorithm is introduced to the MPS-DEM coupling method to solve an FSI problem. A Dam break with an elastic gate is simulated. An adaptive high-resolution domain could trace the deforming elastic gate, shown in Figure 2. With the deforming and moving adaptive refinement domain, the splitting/coalescing times are significantly reduced by more than 60%, while CPU time is decreased by around 40% in comparison with the previous study [3].

[1] D. Zwick, S. Balachandar, Dynamics of rapidly depressurized multiphase shock tubes, Journal of Fluid Mechanics 880 (2019) 441-477.
[2] Z. Ren, B. Wang, G. Xiang, L. Zheng, Effect of the multiphase composition in a premixed fuel–air stream on wedge-induced oblique detonation stabilisation, Journal of Fluid Mechanics 846 (2018) 411-427.
[3] C. Zhang, X. Y. Hu, N.A. Adams, A weakly compressible SPH method based on a low-dissipation Riemann solver, Journal of Computational Physics 335 (2017) 605-620.
[4] Z.-F. Meng, P.-P. Wang, A.-M. Zhang, F.-R. Ming, P.-N. Sun, A multiphase SPH model based on Roe's approximate Riemann solver for hydraulic flows with complex interface, Computer Methods in Applied Mechanics and Engineering 365 (2020) 112999

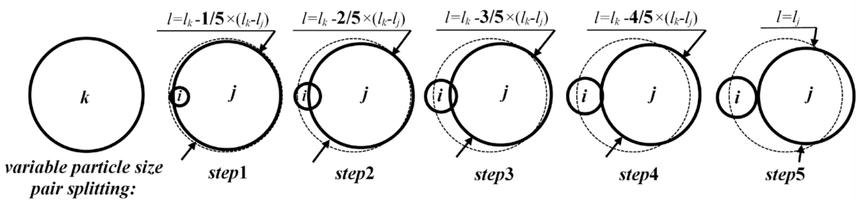

Figure 1 - Schematic diagram of five-step variable particle size pair splitting process

On the convergence of the truncated SPH solution to the hydrostatic problem

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[3]CEHINAV, DACSON, ETSIN, Universidad Politécnica de Madrid (UPM)

Convergence is one of the most important challenges in SPH, and while some interesting works have been published [1,2], the existent literature is scarce. The aim of the work that we are developing is to contribute to the study of convergence of the SPH method by looking further into the existing lines of work and, hopefully, by opening new ones.

We decided to start at the one-dimensional hydrostatic equation with constant density, a simple problem including some interesting ingredients liker kernel truncation at the free surface or mirroring techniques.

First, we studied the problem at the continuous level [3]. The consistency of the continuous truncated operator was analysed, revealing problems at the free surface. The uniqueness of the solution was established. By using Fourier analysis techniques, it was shown that the continuous SPH solution converges to the exact one, provided the fulfilment of certain requirements, being the most important of them being that the SPH solution does not present variations in scales smaller than the smoothing length. When exploring the numerical solution, convergence problems were found for small values of the ratio between the particle distance and the smoothing length.

The problem at the discrete level, taking the form of a system of linear equations, was studied in a second work [4] and some interesting analytical calculations were developed in the case of one neighbour, together with an analysis of the convergence based on the condition number of the matrix.

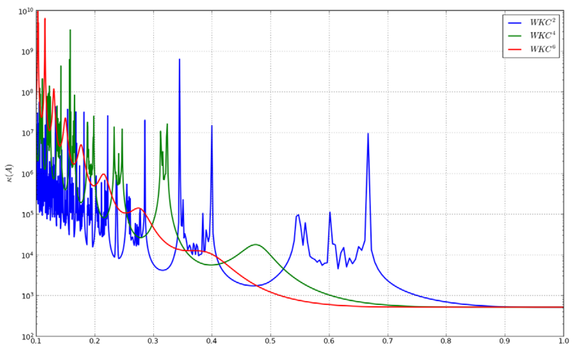

Figure 1 - Condition number depending on the ratio between the particle distance and the smoothing length, and the kernel used

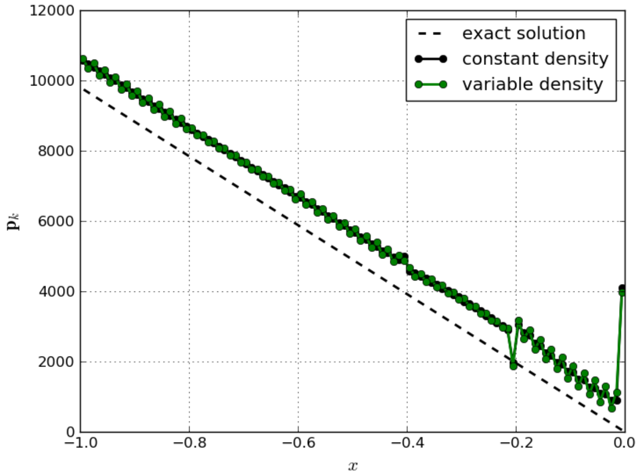

Figure 2 - Comparison of the numerical solutions when either constant density or variable density with an equation of state is used

Currently, we are working on clarifying the relationship between convergence, the condition number and the properties of the kernel. The condition number turns out to play a mayor role in the convergence, and is actually very dependent on the kernel, see Figure 1. Furthermore, the effect of modified operators for the pressure gradient and the way in which the analysis could help in establishing the convergence of a time-dependent hydrostatic problem are also objects of our present work. A first step into this last objective is to study the steady state of a hydrostatic problem in which the density is not constant, but linked instead to the pressure by an equation of state. First studies show that this has little influence in the behaviour of the SPH pressure field, see figure 2.

[1] Franz, T and Wendland, H. (2018) Convergence of the smoothed particle hydrodynamics method for a specific barotropic fluid flow: constructive kernel theory, SIAM J. Math. Anal., 4752:4784
[2] Vila, J. (1999) On particle weighted methods and smooth particle hydrodynamics, J. Math. Models Methods Appl. Sci., 161:209
[3] Macià, F. and Merino-Alonso, P.E. and Souto-Iglesias, A. (2020) On the truncated integral SPH formulation of the hydrostatic problem, J. Comp. Part. Mech. https://doi.org/10.1007/s40571-020-00333-6
[4] Merino-Alonso, P.E. and Macià, F. and Souto-Iglesias, A. (2020) On the numerical solution to the truncated discrete SPH formulation of the hydrostatic problem (2020), (in revision process).

An accurate shock-capturing SPH scheme based on Roe's approximate Riemann solver

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Shock loads exist widely in the field of industry, see e.g. [1, 2]. It is difficult to investigate some flows containing these loads. However, knowledge of their mechanisms is important to reveal some physical phenomena and to inspire engineering applications. Many valuable research on these flows have been performed by experimental and analytical methods. But, for some complex problems, these two methods are still not enough to get comprehensive analysis. With the rapid development of computational methods, numerical methods can be considered as a powerful tool for analysing such flows. As compared to experimental and analytical methods, numerical methods can reproduce some flow structures at a lower cost, and it has been applied to handle many compressible flows, e.g. [1, 2].

As a popular member of meshless methods, SPH plays an increasingly important role in simulating fluid flows today. However, in the SPH community, there are few shock-capturing SPH schemes. The present work is dedicated to providing a novel shock-capturing SPH scheme to handle shock waves.

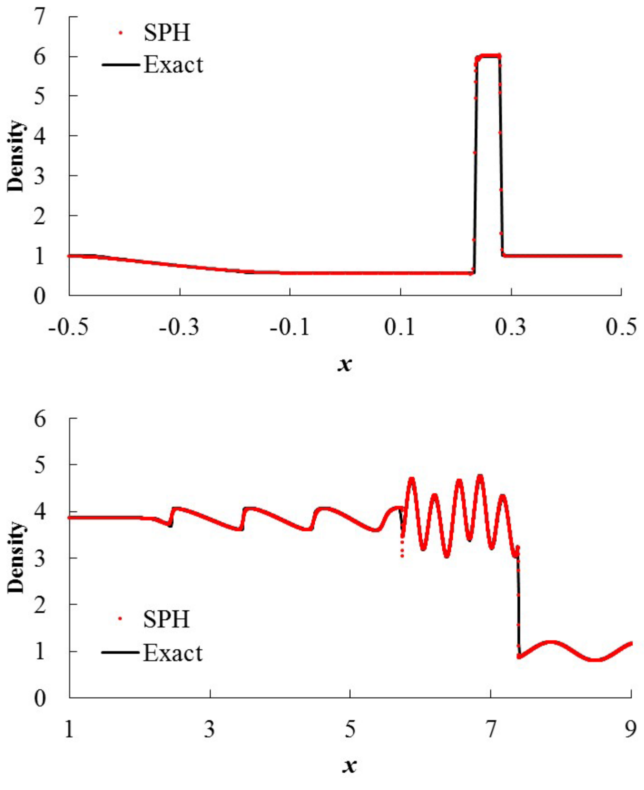

Figure 2 - Top: Density profile for the blast wave problem. Bottom: Density profile for the shock-density wave interaction

In this scheme, the solution of a one-dimensional Riemann problem solved by Roe's approximate Riemann solver is inserted into the SPH formulation. A one-dimensional Riemann problem can be constructed by an interacting particle pair [3, 4]. However, the use of Roe's Riemann solver will lead to excessive numerical dissipations that smear shock profiles. To remedy this problem, we proposed a novel dissipation limiter. It is simple and effective to adjust these dissipations, and with this limiter, a new shock-capturing scheme is constructed. An interesting superiority of the proposed scheme is, for the initial particle distribution, an equal spacing particle distribution can be applied. It is different from previous SPH shock-capturing schemes where the equal mass particle distribution is adopted to simulate compressible flows. In contrast to the latter, the use of the equal spacing particle distribution can make it easier to simulate multidimensional problems.

Some typical numerical benchmarks including strong shocks/discontinuities are selected to verify this scheme. Compared with other SPH methods, the proposed scheme has better numerical accuracy to capture shocks, and can reproduce high wavenumber fluctuations (see Figure 1).

[1] D. Zwick, S. Balachandar, Dynamics of rapidly depressurized multiphase shock tubes, Journal of Fluid Mechanics 880 (2019) 441-477.
[2] Z. Ren, B. Wang, G. Xiang, L. Zheng, Effect of the multiphase composition in a premixed fuel–air stream on wedge-induced oblique detonation stabilisation, Journal of Fluid Mechanics 846 (2018) 411-427.
[3] C. Zhang, X. Y. Hu, N.A. Adams, A weakly compressible SPH method based on a low-dissipation Riemann solver, Journal of Computational Physics 335 (2017) 605-620.
[4] Z.-F. Meng, P.-P. Wang, A.-M. Zhang, F.-R. Ming, P.-N. Sun, A multiphase SPH model based on Roe's approximate Riemann solver for hydraulic flows with complex interface, Computer Methods in Applied Mechanics and Engineering 365 (2020) 112999.

Interverview with Jean-Christophe Marongiu

Jean–Christophe Marongiu started developing SPH during his PhD, which was awarded by Ecole Centrale de Lyon in 2007. Since then he worked in the Research and Development department of for ANDRITZ Hydro. In the SPH community Jean-Christophe is an internationally renowned researcher: he has been one of the members of the SPHERIC Steering Committed from 2008 to 2019, and he has continuously supervised the development of the ASPHODEL code which is used as a key tool for turbomachinery design in ANDRITZ. Being involved both in research and industry gives to him a unique perspective on SPH numerical schemes which hopefully he will share with us in this interview.

When (and why) did you decide to do a PhD? Did you find it formative? If yes in which way?

This happened during the final year of my engineering studies, while I was specializing in turbomachinery at Ecole Centrale de Lyon. For the master thesis, we had to find a project with a company. I was not enthusiastic with the many opportunities stemming from the good relations between the laboratory and a French aircraft engine manufacturer as I had the feeling I would be just one trainee among many others. My supervisor advised me to contact the swiss company VATECH Hydro (now ANDRITZ Hydro) which was offering a master project on numerical simulation of hydraulic turbines. The company had in fact the intention to launch a PhD project and the master was intended to identify a suitable PhD candidate. Although I was willing to work in Research and Development, it was the first time I was considering engaging into a PhD but was not fully convinced yet. It took me the whole master work to decide for the PhD. Looking back to that time, it was undoubtedly the right decision. The PhD offered me three years of intense personal development. Apart from the obvious acquisition of technical expertise and skills (I was the most disastrous student in computer science so I could only improve), I learnt a lot from my supervisors at ECL, EDF and ANDRITZ regarding methodologies for problem solving.

Can you summarize the path that brought you from a PhD to your current job in industry?

The PhD brought the proof that an SPH-based simulation approach was a viable strategy to overcome limitations of mesh-based techniques for free surface flows in Pelton turbines. ANDRITZ Hydro offered me a post-doc position in the frame of the FP6 EU project ESPHI, whose purpose was exactly to foster the dissemination of research results to industry. I had two years to transform my research "code" into a viable industrial tool, which I managed to do (and I thank all those from ECL, from ESPHI and from ANDRITZ who contributed to this great work). At the end of the ESPHI project I stayed with ANDRITZ as CFD engineer, later I became leader of our CFD team for Pelton turbines. Today I am responsible for the R&D department in Vevey (Switzerland) and I am also leading the development of digital solutions for the Operation and Maintenance of hydropower plants.

How the work you are doing today links with your PhD?

After the end of my PhD and post-doc, ANDRITZ managed to dedicate significant resources to the development of SPH and to embed our SPH software in the daily work of our Pelton design team. Since 2015, while our SPH software was becoming more and more stable and mature, topics like data analysis and machine learning became very important in our company, reducing our efforts in further developing our CFD (and among them SPH) tools. However many skills we developed thanks to our SPH technology roadmap (Software programming, High Performance Computing, numerical expertise) are of primary importance in these fields also. I tend to think that my current technological responsibilities in ANDRITZ relate directly to the skills and expertise I developed during my PhD.

Did you think that, having a PhD, has facilitated your career in industry?

The PhD has definitely facilitated the beginning of my career in ANDRITZ because I came with a technology which was strategic for the group. Afterwards, I think I could evolve to new responsibilities because the PhD had equipped me with important soft skills like autonomy, a rigorous and analytical way of solving problems, the capacity to start new activities by self-learning.

What is the coolest thing about your work?

Creation and novelty. Even though I work mostly in the digital world, I consider the development of a software as a tangible creation. Simulation results can be compared to measurements, leading to confidence in the results. Technical solutions developed based on numerical simulations result in a better generation of hydropower.

What are the biggest scientific/technical achievements you reached during your career?

During my PhD, I had enormous issues with predicting the pressure field on a rotating Pelton turbine, and introducing a numerical treatment based on a surface integral term and partial Riemann solvers was definitely a game changer for the application in our industry. Later when we managed to execute the computational workload on GPUs with a speed-up of approximately 25, we were all of a sudden able to provide direct support to turbine designers in their daily activities.

From your perspective, what are the most relevant challenges that the SPHERIC community should address in the near future?

The Grand Challenges defined by the SPHERIC Committee provide the right outlook on the technical topics which deserve investigations and improvements. Apart from those technical aspects, I think the community should pay attention to the proper identification of appropriate applications of the method, which is mainly the trade-off between the added value of SPH and the corresponding computational cost. My opinion is that there is a danger in reproducing results which are already possible with other numerical techniques, without significant added value in term of quality of the results or time to result. Recent advances in other numerical methods have to be considered for any sort of comparison and in that respect, people in the SPH community having a wide numerical culture, possibly being active researchers in other fields of numerical simulation, are of paramount importance. Arguments related to the ease of implementation of SPH are not relevant to end users of well establishedwell-established software packages.

What is your vision of the current state of the art of SPH?
We see better and better use cases of SPH, the method has progressed much in the last 10 years. A promising evolution is the coupling of SPH with other methods, enabling the use of SPH in restricted regions of a simulation domain where it is the best choice. Particle refinement is also a feature of sufficient maturity for usage in real cases. Conversely the deficit of numerical accuracy of the SPH scheme remains a significant difficulty. Despite relevant works related to its understanding and characterization, and the development of various correction techniques, it is still impossible to guarantee basic properties of the SPH interpolation scheme in any configuration. The key ingredient that makes SPH appealing is also the most limiting one. I am more confident for other Grand Challenges.

SPH Online – The First International Online Workshop on SPH

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Amid the recent pandemic, we decided to organise a brief online workshop on SPH, referred to as SPH Online. The workshop aimed at portraying some of the latest developments made in the field of SPH through a set of invited talks as well as a panel discussion on Future Perspectives of SPH.

In order to have the workshop well-organised and to ensure interactivity and security in one of the very first experiences of online workshops on SPH, we decided to welcome a limited number of invited participants. We initially planned to welcome only 45 participants, finally welcomed 53, and had to apologise to several researchers, hoping to welcome them in future SPH Onlines. A total number of 53 participants from 15 universities including Manchester, Kyoto, TUM, NUS, Peking, Tsinghua, Tianjin, Dalian, Harbin, Sichuan, Sheffield, Swansea, Cambridge, Sun Yat-Sen, and City Univ. London participated in this online workshop. All participants registered through sending their registration forms via email and received their unique registration code during the first three days of August.

With Zoom practice sessions and connections checked beforehand, the workshop lasted for about 4 hours starting from 8:00 GMT to 12:00 GMT (5:00 PM - 9:00 PM Japan Time) thanks to the active discussions and impressiveness of presentations. SPH Online started with a welcome message by Abbas Khayyer and then with an opening speech by Benedict D. Rogers, the chair of SPHERIC. Ben introduced the history, aims, organization and contributions of SPHERIC to all participants. Through his opening speech, Ben also encouraged the participants, including young researchers and potential future developers, towards rigorous academic research on SPH through systematic and collaborative research. After the opening speech, we welcomed presentations by five invited speakers, including Georgios Fourtakas from the Univ. of Manchester, Pengnan Sun from Sun-Yat Sen University, Zhilang Zhang from Peking University, Min Luo from Swansea University and Chi Zhang from Technical University of Munich. The invited talks corresponded to i) a concise and comprehensive introduction to DualSPHysics by Georgios Fourtakas on behalf of the DualSPHysics team; ii) an impressive presentation on highly compressible multiphase flows by Pengnan Sun; iii) an advanced study on hydroelastic FSI by Smoothed Particle Element Method (SPEM) by Zhilang Zhang; iv) a concise presentation of Consistent Particle Method (CPM) and its application to multiphase flows, and finally, v) an impressive talk by Chi Zhang on multiphysics application of SPH including human heart through an open-source SPH Library, namely, SPHinXsys. Every talk was scheduled to be delivered within 18 minutes and was followed by several insightful questions from the participants during the 7 minutes of allocated discussion time.

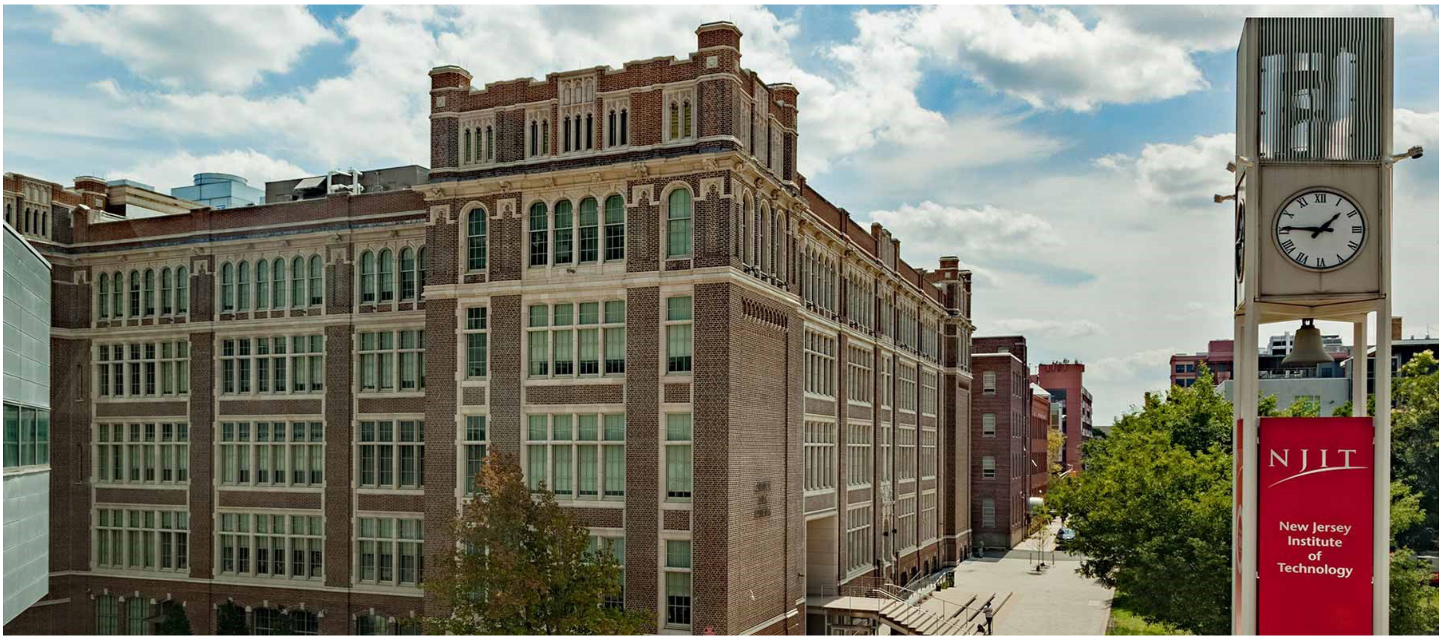
After our five invited talks, Ben Rogers chaired a panel discussion on SPH Future Perspectives. Songdong Shao, Bing Ren and Abbas Khayyer were the other panel members. The discussion was mainly focused on six relevant questions suggested by panel members and speakers. Participants had been informed about the format of panel discussion as well as six corresponding questions six days in advance of the workshop via email with many responses received in advance of the workshop. The six questions of panel discussions included:

SPH Future Perspectives Questions:

1. Where does SPH stand in the world of computational technologies?
2. What kind of challenges do we need to overcome rigorously to have SPH being recognised as a reliable and versatile computational method? (only SPH Grand Challenges as specified by SPHERIC?)
3. Where will SPH shine more? (e.g. specific applications that conventional methods including grid-based methods may not easily handle as SPH does)
4. What should be the focus of SPH Ph.D. Research? SPH Grand Challenges as specified by SPHERIC (e.g. convergence, stability, boundary conditions, coupling with other methods, application to industry, etc.)? SPH extended applicability?
5. Do we need more international working groups comprised of engineering experts and mathematicians/physicists to accomplish more rigorous developments for SPH?
6. Optimization of SPH Computational Efficiency (towards real-time real-scale simulations as well as running 3D simulations on a desktop machine)

Throughout the panel discussion, participants and panel members highlighted the need for continued rigorous and systematic research on SPH Grand Challenges as well as some other challenges corresponding to turbulence as well as boundary layers. As for question 5, in general, the idea was highly welcomed and at the same time it was emphasized that such working groups need to be thoughtfully established for continued contributions to SPH development. An interesting suggestion by Min Luo corresponded to updated systematic comparison of the state-of-the-art of Weakly Compressible SPH with that of projection SPH (ISPH). The panel discussion continued for about 45 minutes with many participants being actively involved.

After the panel discussion, the workshop continued by a concluding remarks speech by Professor Shaowu Li from Tianjin University and then by final words of Abbas Khayyer on i) SPH Special Issue in Applied Ocean Research, ii) acknowledgement to all organizers, speakers and participants, and finally, iii) announcement of the winner of the best presentation award (Dr Pengnan Sun). All participants welcomed the idea of organizing future SPH Online workshops especially during this pandemic. In particular, future SPH Online Workshops were suggested to be more focused on specific topics, e.g. SPH Grand Challenges, with more researchers and experts being invited to participate. The recorded videos of the workshop are available at [Part I] (^fL*Mcg2) and [Part II] (1z.kJ*VN), with passcodes being given in parentheses. Figure 1 corresponds to screenshots showing the participants of SPH Online. The second SPH Online Workshop, namely, SPH Online II, is scheduled to be organized on Monday, March 29, 2021.



15th SPHERIC International Workshop, Newark NJ (June 8-10, 2021)

Dr. Angelo Tafuni

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The SPHERIC International Workshop is the annual global forum for development and applications of Smoothed Particle Hydrodynamics (SPH) and related methods. During the workshop, the latest advances in the SPH method are presented. In addition, the optional training day offered the day before the start of the workshop offers an intensive introduction to the theory and application of SPH.

The 2020 edition of the SPHERIC Workshop has been canceled due to the COVID-19 pandemic. The next SPHERIC International Workshop will take place in the United States of America on June 8-10, 2021. The 15th edition of the workshop will be hosted by the Newark College of Engineering at New Jersey Institute of Technology in Newark (NJ), led by assistant professor Dr. Angelo Tafuni.

Newark is located in the heart of New Jersey's Gateway Region, approximately 8 miles (13 km) west of New York City. The city of Newark is a major hub of air, road, rail, and ship traffic, making it a significant gateway into the New York metropolitan area and the mid-Atlantic United States. The city is also home to Newark Liberty International Airport, the second-busiest airport in the New York metro area and the 15th-busiest in the United States in terms of passenger traffic.

More info will soon become available at www.spheric2021.com.

We look forward to welcoming you in Newark and sharing a successful and enjoyable meeting with you!

73rd Annual Meeting of the APS Division of Fluid Dynamics, Chicago I

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The 73rd Annual Meeting of the American Physical Society's Division of Fluid Dynamics (DFD) will be held on **November 22-24, 2020**. The regular in-person meeting, originally planned to take place in Chicago IL, has been cancelled due to the COVID-19 pandemic still ongoing. The 2020 meeting will instead consist broadly of two live-streamed parallel tracks of invited talks running in parallel Sunday, November 22-Monday, November 23, all with following on-demand access. Interspersed throughout the three days will be networking events, the Gallery of Fluid Motion, and exhibitor advertising and promotions. Abstracts will be organized with author-provided supplemental materials available through all three days, including opportunities for Q&A.

The DFD annual meeting is one of the largest conferences in fluid dynamics, with 3000+ attendees from around the world. The objective is to promote the advancement and dissemination of knowledge in all areas of fluid dynamics. Undergraduate and graduate students, postdoctoral researchers, university faculty, and researchers across government and industry are encouraged to share the latest developments in the field.

The scientific program will include four award lectures, along with twelve invited lectures, four minisymposia sessions, and numerous focus sessions. Among these, a focus session will be dedicated to "SPH and Mesh Free Methods", category 8.10 in list of abstract sorting categories.

You can submit an abstract by August 3, 2020 at the following address: **http://abstracts.aps.org**, Please be sure to select "73rd Annual Meeting of the APS Division of Fluid Dynamics, Chicago, Illinois".

Find more info at: **https://dfd2020chicago.org**

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