



Scientific Collaboration

We have had a busy time since our last newsletter, completing many of our administrative and initial research deliverables, and continuing on our research and training journey in TUSAIL. We were delighted to be able to finally come together for the first time in June-July of this year, hosted by Prof. Massimo Poletto and Assoc. Prof. Diego Barletta at the Università degli Studi di Salerno.

In this stunning Italian city, our Senior Training Mentor, Dr Vanessa Magnanimo (University of Twente) ensured that collaborative working featured at the core of our activities. An inspiring and invaluable workshop, **Power of Connection for Team Collaboration** delivered by [Claudia Hopman](#), really focused our minds on how to address gaps in our joint endeavours and teased out how we can work more effectively in the delivery of our goals in TUSAIL.

Joining us, we had our External Advisory Board – Prof. Alberto Di Renzo, University of Calabria; Prof. Christine Hrenya, University of Colorado Boulder; and Dr Luis Martin de Juan, AstraZeneca – who enhanced our scientific discussions and shared their expertise. We also had the pleasure of meeting our EU Project Officer, Apostolos Paralikas, who came to complete our Mid-term Check as part of our activities in Salerno. Again, it was fantastic to engage with our funder face-to-face and reflect on our shared vision for European R&D.

We also took the opportunity to hold a TUSAIL workshop in conjunction with the 10th International Conference on Conveying and Handling of Particulate Solids (CHoPS 2022) in the first day of the conference. We were able to introduce the TUSAIL ITN Consortium to the audience, to inform the community of what we are trying to do and set out the challenges. The workshop concluded with a panel discussion on the scientific challenges with active audience participation.

This week, we are excited to be meeting in Enschede, Netherlands, hosted by Prof. Stefan Luding of the University of Twente/Mercury Lab.

Prof. Jin Ooi, Project Coordinator



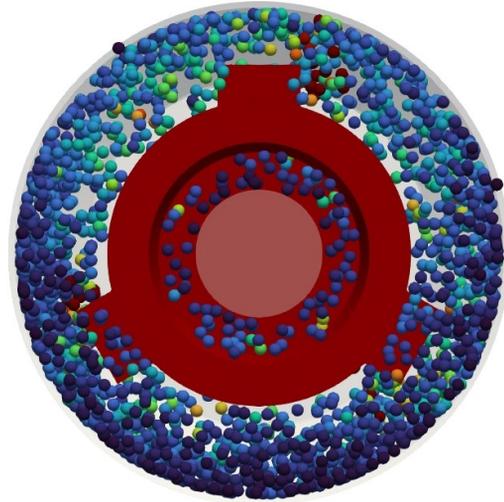
Our ESRs



Have you wondered about modelling of particle breakage?

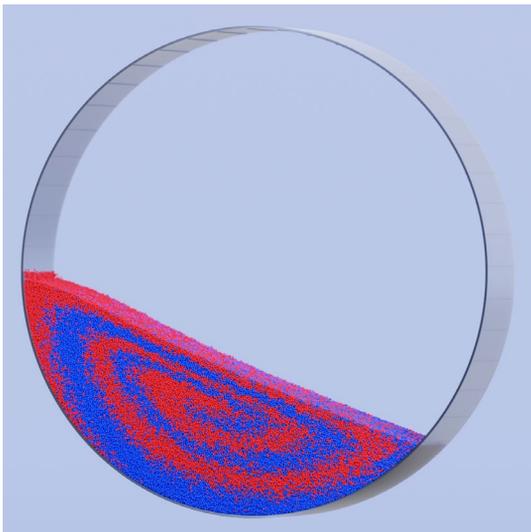
Our ESR, Yeswanth Sai Tanneru, is currently working on modelling of fine grinding in stirred media mills. His research focuses on using methods like DEM and CFD to model the mills and population balances to predict the evolution of particle breakage. Yeswanth is originally from India where he did his bachelor in Mechanical Engineering and he got his master degree in Applied Mechanics from Sweden. He is currently located at iPAT, TU Braunschweig (Germany) and has Nestlé as his industrial partner. His secondments are planned at DCS Computing (Austria) for CFD-DEM modelling and TU Hamburg (Germany) for flowsheet modelling.

The challenge of his current research is that breakage in mills is a rapid phenomenon and implementing the breakage physics to simulate the exponentially increasing number of particles is computationally heavy. In this work, DEM and CFD simulations are used to obtain the necessary mill dynamics at different operating conditions. The population balance models predict the breakage and evolution of particle sizes due to breakage.



Are you interested in mixing and segregation?

Our ESR Balázs Füvesi is working on mixing and segregation processes using meso-particles (coarse grained particles) for industrial scale application. Balázs has graduated as a chemical and process engineer from University of Pannonia in Hungary, where he has been involved with DEM simulations since his early bachelor studies when he joined a research program for students and simulated silo discharge with a rotary valve. Later on, he continued in this field and during his master thesis he developed a GPU-accelerated DEM simulation software.



His current research deals with better understanding the mixing and segregation effects when using coarse graining. Due to the large number of particles in industrial scale, DEM has a high computational demand. By using coarse graining, the number of simulated particles can be reduced, thereby decreasing the computational effort. Coarse graining is a widely researched area in the context of DEM for granular materials. However, it is still not well understood how the upscaling of particle sizes affects the simulation of mixing and segregation processes. After one year at University of Twente, Balázs is now located at DCS Computing in Vienna, Austria.

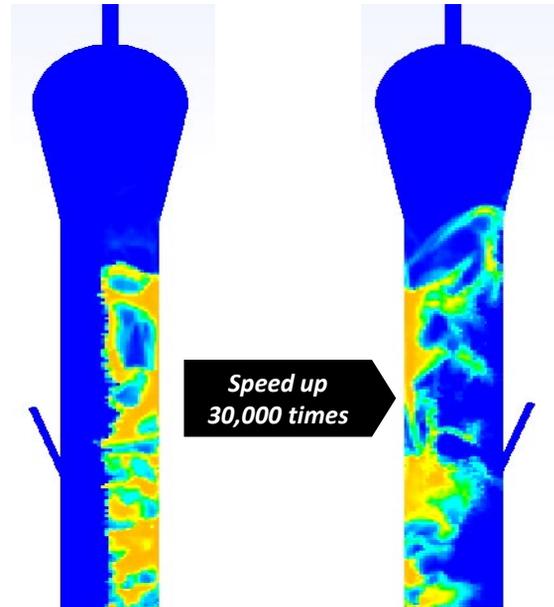
Our ESRs



Are you interested in recurrence CFD?

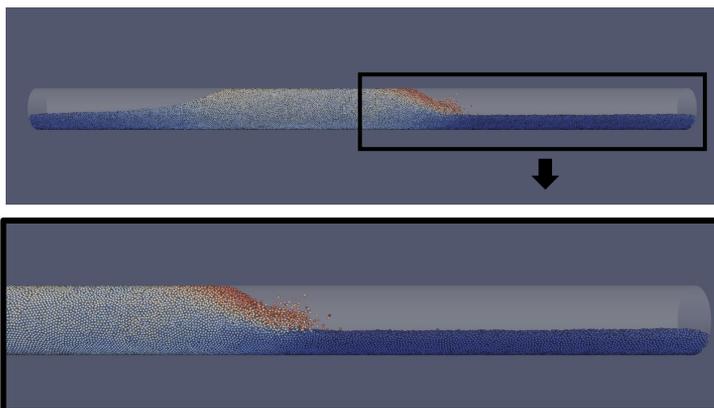
Our ESR Varun Dongre is currently working on time-extrapolation of continuum two-fluid model simulations of spout fluidized beds. His research focuses on developing data-based recurrence CFD to speed-up the simulations (up to real-time), as convectional CFD simulations are expensive.

Varun is from Bengaluru, India and he graduated with his bachelor degree in Mechanical Engineering and master degree in Automotive Engineering from Sweden. He is currently located at department of particulate flow modelling in JKU (Austria), and has Hamburg University of Technology as his academic partner. Varun's secondment is planned at Procter & Gamble (Newcastle, UK) to apply rCFD to an industrial-scale fluidized beds. His current research deals with evaluation of predictive capabilities of rCFD, focusing on gas-solid heat transfer. Besides this, he is working on finding out a better method of sequence stitching to efficiently improve the results for gas-solid mixing and secondary gas washout. rCFD method stands out to simulate fluidized beds almost 30,000 times faster than full CFD simulations.



How complex is it to model dense particulate flows?

Our ESR, Oguzhan Erken is working on usage of meso-scale particles in pneumatic conveying. Oguzhan is from Turkey and obtained his bachelor in Mechanical Engineering at Bogazici University and master at Koc University Mechanical Engineering department. He is currently at the University of Edinburgh and has Procter & Gamble as his industrial partner.



The aim of his project is to reduce the computational expense of CFD-DEM simulations of pneumatic conveying by developing a quantitative and predictive simulation method using meso-scale particles, which accurately account for the fundamental gas-solid interactions. For this purpose, Oguzhan will use experimental data from lab- and pilot-scale pneumatic conveyors to derive appropriate scaling relations that will be incorporated into the simulations.

The desired output of this project is a practically useful approach to design and optimise pneumatic conveyors for a broad range of industrial applications at an acceptable computational cost.

2nd Doctoral School

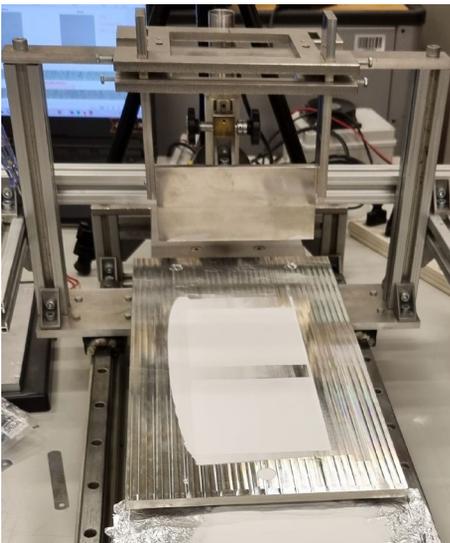
Laboratory Workshop



As a part of the trainings from TUSAIL, we had different courses on working with granular material. The first two days of the second TUSAIL School at University of Salerno were a combination of lectures and lab work. In the mornings, we had lectures on bulk material testing, design of experiments and heat transfer in fluid and particle systems. In the afternoons, we went to the laboratory where we had a workshop on bulk material testing.

The workshop was focused on six material testing methods spanned over the two afternoons. We worked in small groups and were able to learn more about granular behaviour and get hands on experience. On the first day, the two local TUSAIL ESRs Rahul Sharma and Assem Zharbossyn presented us the ring shear tester. The other two experiments for day-1 were bed preparation for selective laser sintering and uniaxial compression. On the second day, the three experiments were the static angle of repose, characterisation of heat conduction in a selective laser sintered thin bed and torque measurement in a powder rheometer at different fluidisation states.

- Balázs Füvesi



2nd Doctoral School

C++ Workshop



Our workshops continued on Wednesday and Thursday with the Advanced C++ course by Dr. Thomas Weinhart from MercuryLAB, assisted by our ESRs Retief Lubbe and Max Winkelmann. In these lectures, we had a chance to get familiarize with C++ and some of its concepts. This workshop included lectures from the fundamentals up to getting insights on advanced concepts like object-oriented programming. Towards the end of the lectures, we also worked on some simple DEM codes written using C++. This helped us to have some idea on how C++ is actually applied in DEM software. Practical sessions, where ESRs put their freshly gained knowledge into practice, were important part of this workshop. In these sessions, we worked on an example problem about the concepts that we had just learned and got our questions clarified by Dr. Thomas Weinhart. Considering the importance of having proper coding skills in our projects, it can easily be said that this workshop was essential.

- Oguzhan Erken



2nd Doctoral School

Collaborative Research

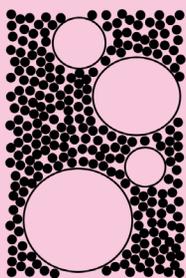
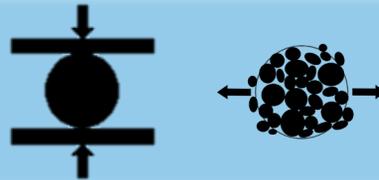


On the final day of the doctoral school, we (the ESRs) presented our research topics and initial results. Prof. Hrenya, Prof. Di Renzo and Dr. Martin de Juan from the External Advisory Board (EAB) along with the members of the TUSAIL Supervisory Board offered suggestions and feedback on individual ESR projects. This was followed by a workshop on collaborative research. Based on the individual research goals and nature of the particulate processes, the ESRs were grouped for promoting knowledge sharing and collaborative research. The session concluded with a short discussion on “Common Scientific Challenges”.

- Jobin Raju

Breakage

ESR3: Jobin Raju
ESR4: Yeswanth Sai Tanneru



Fluidization

ESR1: Gero Stöckl
ESR6: Oguzhan Erken
ESR14: Behrad Esgandari
ESR15: Varun Dongre

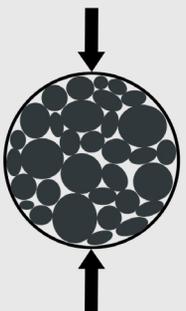
Dense Granular Flows

ESR6: Oguzhan Erken
ESR7: Roxana Saghafian Larijani
ESR8: Balázs Füvesi
ESR9: Rahul Sharma
ESR10: Assem Zharbossyn
ESR11: Akhil K Mathews
ESR12: Retief Lubbe
ESR13: Max Winkelmann



Agglomeration & Tableting

ESR1: Gero Stöckl
ESR2: Amine Ait Ouazzou
ESR5: Afshin Taghizadeh
ESR7: Roxana Saghafian Larijani
ESR9: Rahul Sharma

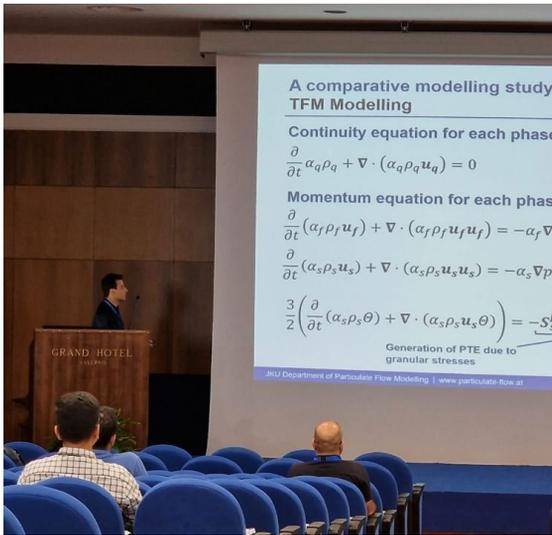


Multiphase Flows

ESR1: Gero Stöckl
ESR2: Amine Ait Ouazzou
ESR6: Oguzhan Erken
ESR7: Roxana Saghafian Larijani
ESR14: Behrad Esgandari
ESR15: Varun Dongre

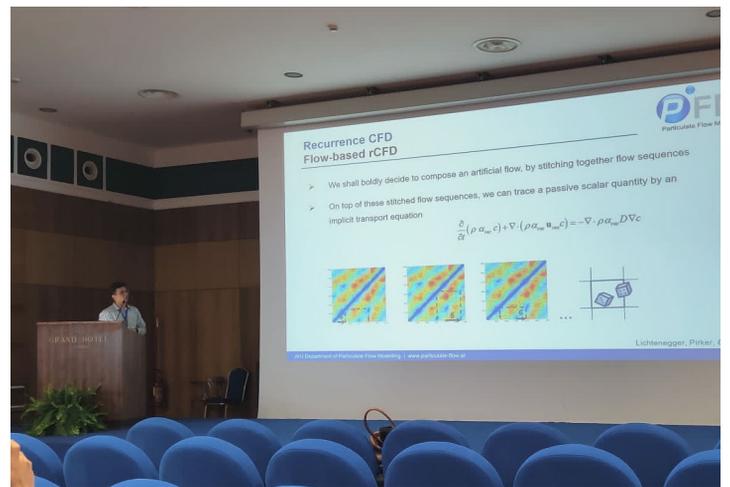
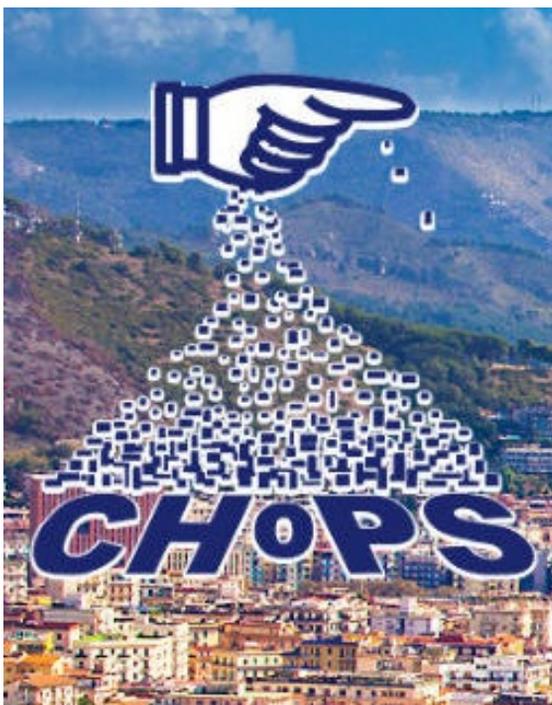


CHoPS Conference



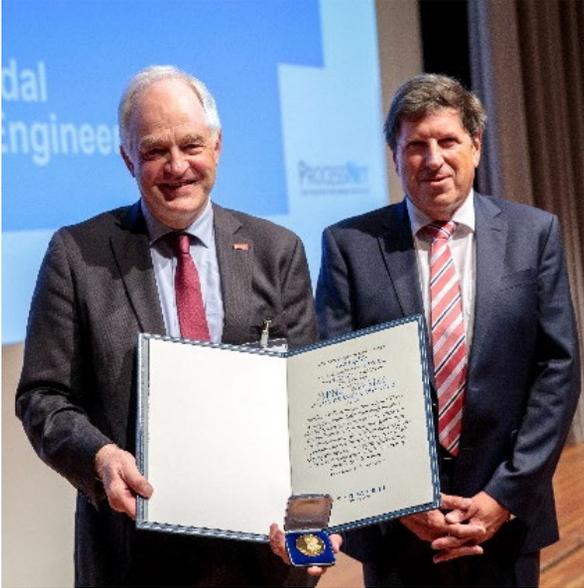
As a part of our network events, we took part in the first day of the 10th International Conference on Conveying and Handling of Particulate Solids (CHoPS 2022), which took place in Salerno from 5th to 9th of July, 2022. We attended the plenary lecture by H. Jaeger in the morning followed by the TUSAIL Symposium until the afternoon. It started with the talks from our ESRs Behrad Esgandari and Varun Dongre, where they presented the preliminary results from their projects, followed by the discussions with the fellow researchers and scientists that attended our symposium. After the TUSAIL symposium, the day continued with the plenary lecture from D. Schott and few other parallel sessions, which we attended according to our areas of interest. On the third day of CHoPS, our ESRs Amine Ait Ouazzou, Rahul Sharma and Assem Zharbossyn had their respective project posters displayed in the poster flash presentations.

- Oguzhan Erken



News and Awards

Arno Kwade receives the Hans Rumpf Medal 2022



Prof. Dr.-Ing. Arno Kwade, Work package 6 Leader and Director of the Institute for Particle Technology (TU Braunschweig, Germany), has received the Hans Rumpf Medal 2022 for his outstanding research in the field of mechanical process engineering.

He has received this honor at the ProcessNet annual conference in Aachen. The ProcessNet medals are awarded to work that has led to the deepening or expansion of the basics of the respective subject or to an exemplary application in industrial practice. Prof. Dr.-Ing. Arno Kwade in particular has made significant contribution to the research about comminution and dispersing, the results of which have industrial applications in areas as diverse as battery manufacturing and pharmaceutical formulation.

Aspherix® & CFDEM® Conference

The TUSAIL network will have its 4th doctoral school in Linz, Austria. This event is hosted by DCS Computing, one of the partners in our network. The doctoral school will run in parallel with the 4th Aspherix® & CFDEM® Conference which is also hosted by DCS Computing. The conference will be held in-person on 20-21 April 2023 in Linz, Austria. For further information visit www.aspherix-dem.com/conference.

The TUSAIL school begins on the 18th of April with 2 days of network events, followed by the conference for 2 days and the network events continue for 1 week after the conference.

4th ASPHERIX® & CFDEM®

CONFERENCE

20-21 APRIL 2023
LINZ, AUSTRIA

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The Consortium



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UNIVERSITY
OF TWENTE.

Stefan Luding
Vanessa Magnanimo
Anthony Thornton
Thomas Weinhart



Jan Henrik Finke
Arno Kwade
Carsten Schilde

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