Consultant Feedback

Process System Engineering

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Since April 1st, 2022

Topics of my presentation

- Conference Report (APT2021)
- Research areas and people of interest
- Comments on scientific quality of new proposals in system engineering (Numerical modeling of spray droplet formation)

APT2021

The 8th Asian Particle Technology Symposium

Date : October 11(Mon.) – 14(Thur.) 2021
Venue: Congre Convention Center (Osaka, Japan)
Type : Hybrid (on-line & face to face）

Number of Presentation : 259
Number of Attendance : 416 (16 countries)


Welcome

MESSAGE

First of all, I would like to express my deepest condolence and sympathy to all those affected by COVID-19, which continues to spread around the world. At the same time, I sincerely appreciate all your support and contribution to this symposium.

On behalf of the organizing committee, we hereby declare the opening of the 8th Asian Particle Technology Symposium (APT 2021) at Osaka, Japan. The theme of the symposium is "Challenges for the new era". Unlike the time when we decided the theme nearly four years ago, it is not easy to get rid of the anxiety about the future. Because we are in this era, it is necessary to work together to overcome the difficulties and make this era fruitful and happy.

In this symposium, we are expecting the lively and active discussions on the cutting edge technology, revolutionary idea, innovated methods, new solutions and fundamental theories, which can open the door of a new technology era. The symposium also provides academic and engineers in all over the world including Asia Pacific countries to learn and share their expertise and knowledge in particle technology. Finally, I sincerely hope this symposium is useful and successful to all of you.

Yours sincerely,

Satoru Watano

Chairperson of APT2021

Osaka Prefecture University


Congre Convention Center


Powder Technology Exhibition (Osaka)

Plenary Speaker


M. Ghadiri (UK)


S. Heinrich (Germany)


J. Litster(UK)


M. Naito (Japan)


A. Yu (Australia)


R. Dave (USA)


A. Tsutsumi (Japan)

Invited Speaker


J. Bodycomb(USA)


M. Fuji (Japan)


W. Ge (China)


A. Kwade (Germany)


M. Louge (USA)


T. Mori (Japan)


P. Mort (USA)


J. Ooi (UK)


M. Sakai (Japan)


Y. Shen (Australia)


C. Sinka (USA)


H. Takeuchi (Japan)


C. Tokoro (Japan)


C.Y. Wu (USA)


C. Wu （UK)


A. Yip (New Zealand)


Y. Shen (Australia)


R. Lau (Singapore)


G. Ma (China)


H. Suzuki (Japan)


J.H. Kim (Korea)


K.S. Kim （Korea)


B. Purevsuren (Mongolia)


T. Charinpanitkul (Thai)


J. Yamada （Japan）

Presentation topics at APT2021

Topics	Number of presentation	% of presentation
Modelling and simulation	52	20.1
Particle synthesis and functionalization	30	11.6
Particle technology for material science	30	11.6
Particle technology for energy and power sources	20	7.7
Particle technology for pharmaceuticals	15	5.8
Dispersion/aggregation/colloidal processing	14	5.4
Characterization	12	4.6
Agglomeration and granulation	11	4.2
Fluidization and multiphase flow	10	3.9
Mixing and separation	9	3.5
Particle interactions and interfaces	9	3.5
Aerosol	8	3.1
Electrostatics	8	3.1
Recycling and waste management	8	3.1
Coating and surface modification	7	2.7
Particle technology for life science	6	2.3
Packing, compaction, and consolidation	5	1.9
Comminution, milling, grinding	4	1.5
Handling and flow of particulate systems	1	0.4
Total	259	100.0

Sustainable Development in Powder Technology

1. **Cost effective processing**

   Optimum and energy efficient operation, decrease in loss

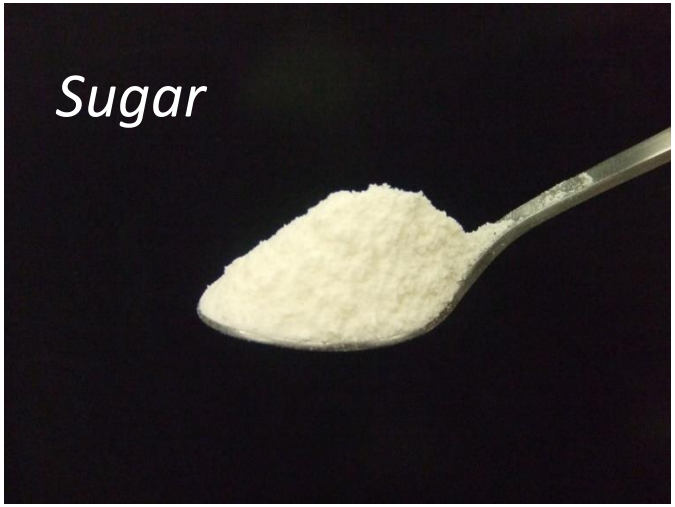
   Decrease in energy i.e., shift from wet to dry processing

   Desolventizing process i.e. use of alternative solvent, Supercritical CO_2
   Supercritical H_2O

2. **Development of energy storage materials**

   All solid type Lithium ion battery

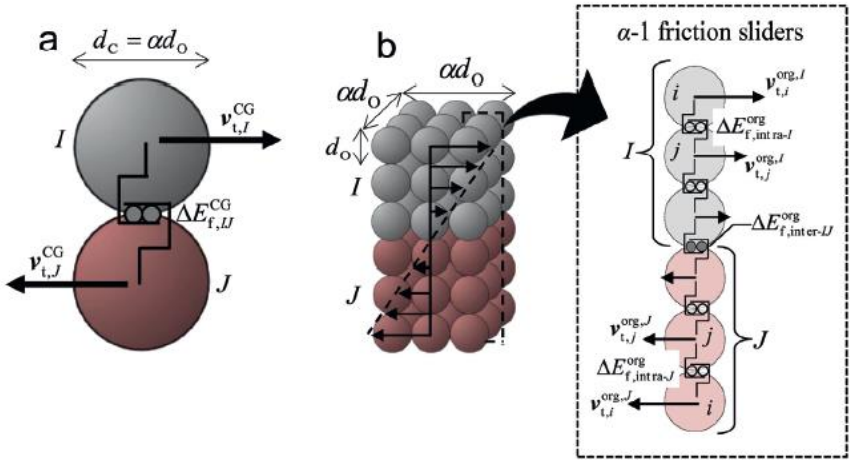
DEM ・・・promising and strong tool for powder !!



If you use supercomputer, you may simulate real powder flow in few hours.

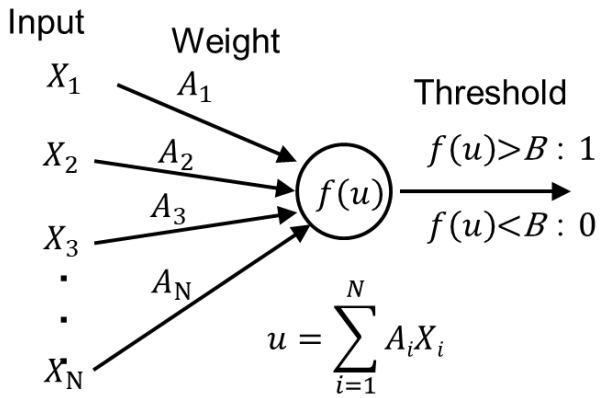
How can we reduce simulation time with keeping high accuracy ??

- *Coarse grain model*



- *Use machine learning or AI (Artificial Intelligence)*

- Parameter calibration



Coarse-grained DEM

Multiphase (Gas-solid) flow

Prof. Mikio Sakai
(The University of Tokyo, Japan)

Sakai M., Abe M., Shigeto Y., Mizutani S., Takahashi H., Viré A., Percival J.R., Xiang J., Pain C.C. (2014) Chem. Eng. J. 244 33-43 10.1016/j.cej.2014.01.029
Takabatake K., Mori Y., Khinast J.G., Sakai M.(2018) Chem. Eng. J. 346 416-426 10.1016/j.cej.2018.04.015
Sakai M. (2016) KONA Powder and Particle Journal 33 169-178 10.14356/kona.2016023

Contact dominant granular flow

Prof. Hideya Nakamura
(Osaka Metropolitan University, Japan)

Saruwatari, M., Nakamura, H. Chem. Eng. J. 428. 130969 (2022) 10.1016/j.cej.2021.130969
Kishida, N., Nakamura, H., Takimoto, H., Ohsaki, S., Watano. S. Powder Technol. 390 1-10 (2021) 10.1016/j.powtec.2021.05.028
H. Nakamura, H. Takimoto, N. Kishida, S. Ohsaki, S. Watano. Chem. Eng. J. Adv. 4 (2020) 100050. doi:10.1016/j.ceja.2020.100050.

Cohesive powder flow

Prof. Kimiaki Washino
(Osaka University, Japan)

Hu Y., Chan E.L., Tsuji T., Tanaka T., Washino K. (2022) Powder Technol. 404 117483 10.1016/j.powtec.2022.117483
Chan E.L., Washino K. (2018) Chem. Eng. Res. Des. 132 1060-1069 10.1016/j.cherd.2017.12.033
Washino K., Chan E.L., Tanaka T. (2018) Powder Technol. 325 202-208 10.1016/j.powtec.2017.11.024

Prof. Johannes Khinast

Graz University of Technology, Austria
Institute for Process and Particle Engineering
Research Center Pharmaceutical Engineering

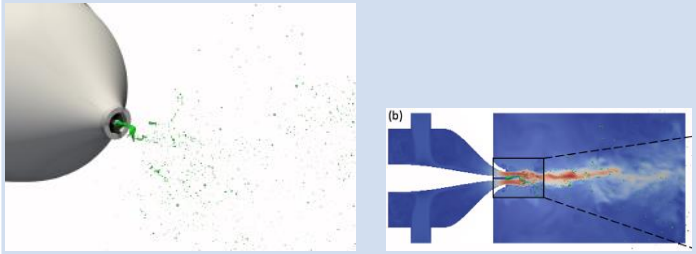
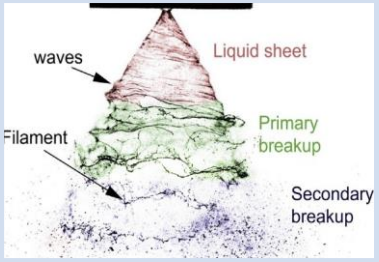
- Large-scale
- Parameter calibration
- Coarse-grained DEM etc

http://www.pssrc.org/member-directory/johannes-khinast

https://graz.pure.elsevier.com/en/persons/johannes-khinast

New Project and Renewal Proposals: 2022

Type	No.	C	SR	F	D	W	SE	Project	Research Associate	Institution	Country
Reviews	1			X				~~Sustainability of Particle Formation Technologies~~			
	2				X			Dynamic Powder Flow	Nico Gray	U. Manchester	UK
	3				X			Horizons in Dry Granular Modeling - Beyond DEM	Farhang Radjai	U. Montpellier	France
Proposals	1				X			Aeration & Deaeration of Geldart C Powders	Olivier Pouliquen	Aix Marseille U.	France
									~~Brunello Formisani~~	~~U. Calabria~~	~~Italy~~
	2				X	X		Drying of Wet Powders with Shear to Prevent Agglomerate Formation	Heather Emady	Arizona State U.	US
									Alban Sauret	UCSB	US
	3			X				Spray Drying of Pastes to Improve Sustainability	Volker Gaukel	KIT	Germany
	4			X			X	Numerical Modeling of Spray Droplet Formation	Olivier Desjardins	Cornell U.	US
									Meng Wai Woo	U. Auckland	NZ
	5					X	X	Computational Modeling of Suspensions	~~Jim Swan~~	~~M.I.T.~~	~~US~~
									Roseanna Zia	Stanford U.	US
	6					X		Dry Powder Reconstitution	~~John Fitzpatrick~~	~~U. College Cork~~	~~Ireland~~
									~~Erik van der Linden~~	~~Wageningen U.~~	~~Netherlands~~
Renewals	1	X				X		Wetting and dispersion of Powders	C. Gaiani	U. Lorraine	France
	2	X		X		X		Characterization of Spray Nozzles at Industrial Conditions	N. Ashgriz	U. Toronto	Canada
	3	X				X		Slurry and Paste Rheology	E. Koos	U. Leuven	Belgium

Name	Olivier Desjardins	Meng Wai Woo
Affiliation	Cornell University, USA Recommended !	The University of Auckland, NZ
Proposal Title	High-Fidelity Modeling of Atomization from Nozzle Flow to Fully Developed Spray	Unveiling the Potential of CFD for Nozzle Spray Prediction
Graphics		
Method	LES(Large Eddy Simulation) + Conservative Eulerian method + Break-up model	VOF (Volume of Fluid) + DPM(Discrete Phase Model)
Method Description	・LES of two-phase flow for liquid destabilization and break-up prediction ・Conservative Eulerian method for subgrid scale liquid features (thin film and thin ligaments) tracking ・A simple break-up model for thin film to droplets transformation	・VOF for filament or cone formation prediction ・DPM for Primary droplet prediction
Experimental validation	・Liquid Effective path length (X-ray) ・Outline of spray (Back-lit image analysis) ・Droplet size and velocity (Phase Doppler)	Use experimental data from literature
Nozzle Type	Two-fluid air-blast nozzle	Single fluid pressure (swirl) nozzle
Fluid type	Newtonian and non-Newtonian fluids	Newtonian and non-Newtonian fluids
Availability of code	Open-source code NGA2 will be available	No mention