

Editorial: Powders & Grains 2021

9th International Conference on Micromechanics of Granular Media

María Alejandra Aguirre^{1,*}, Stefan Luding^{2,**}, Luis A. Pugnaloni^{3,***}, and Rodrigo Soto^{4,****}

¹Departamento de Física, Facultad de Ingeniería, Universidad de Buenos Aires, CONICET, Paseo Colón 850, C1063ACV Buenos Aires, Argentina

²MSM, ET, MESA+, Universiteit Twente, P.O. Box 217, 7500 AE Enschede, Netherlands

³Departamento de Física, Facultad Ciencias Exactas y Naturales, Universidad Nacional de La Pampa, CONICET, Uruguay 151, 6300 Santa Rosa (La Pampa), Argentina

⁴Departamento de Física, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, 8370449 Santiago, Chile

Abstract. *Granular matter, particulate matter and granular materials* are generic terms to refer to systems composed of many macroscopic bodies (grains or particles) where the contact interaction (which is non-conservative) plays a crucial role in the behavior of the system. This contrasts with other systems (*e.g.*, atomic or molecular systems) where the constituent bodies (*e.g.*, atoms or molecules) interact via conservative forces. The non-conservative contact interactions come from inelastic collisions (due to plastic deformation, sound or heat production) and also from friction. This makes the study of granular matter a major challenge to scientists and the handling/storage/processing of granular materials a major challenge to engineers. Particulate matter covers a very broad range of systems, from those formed by fine particles (powders) to those formed by large rocks (derbis), from soft bodies (cotton balls) to hard grains (glass beads), from those we eat (muesli) to those we play with (beach sand), from those used to build our houses (cement) to those used to grow our crops (soil). Needless to say, any new knowledge in this area has a tremendous potential to impact our lives and our economy. *Powders & Grains* is a conference held every four years to bring together researchers working both in fundamental aspects of granular matter and in technological applications. This volume collects the 195 papers presented during the 2021 edition of P&G, which provide an excellent overview of the current state-of-the-art in granular matter and new trends with contributions from six continents.

1 Powders & Grains: goals and scope

The goal of *Powders & Grains 2021* is to share the state of the art in the physics and micromechanics of granular media. P&G is an international scientific conference held every four years. It distinguishes itself from other meetings on granular materials by: (a) the mixture of disciplines, (b) single session talks, and (c) refereed conference papers published online before the meeting. Past meetings were hosted at Clermont-Ferrand (1989), Birmingham (1993), Durham (1997), Sendai (2001), Stuttgart (2005), Golden (2009), Sydney (2013) and Montpellier (2017).

The proceedings of the most recent editions can be accessed at

- P&G 2017: [EPJ-WoC Vol. 140](#)
- P&G 2013: [AIP Conf. Proc. Vol. 1542](#)
- P&G 2009: [AIP Conf. Proc. Vol. 1145](#)

The present P&G 2021 collection includes 4 review papers and 191 contributed papers organized in the following sections:

- 1 Invited Papers
- 2 Granular solids
- 3 Granular flow
- 4 Granular gas
- 5 Particle Properties
- 6 Particle shape effects
- 7 Particle breakage
- 8 Cohesive granular materials
- 9 Fluids and particles
- 10 Material instability
- 11 Geomaterials
- 12 Powder processing
- 13 Environmental granular processes
- 14 Particle simulations and particle-based methods
- 15 Miscellaneous

Each paper was reviewed by at least two anonymous colleagues selected from the Scientific Committee, the invited speakers, the Local Committee and other experts in the field. The peer-review process took four months.

*e-mail: maaguir@fi.uba.ar

**e-mail: s.luding@utwente.nl

***e-mail: luis.pugnaloni@exactas.unlpam.edu.ar

****e-mail: rsoto@dfi.uchile.cl

2 Organizing Committees

2.1 AEMMG Association

The “Association pour l’Etude de la MicroMécanique des Milieux Granulaires” (AEMMG, <https://www.powdersandgrains.org>) is an association created to promote the *Powders & Grains* meeting every four years. It was created by Roland Gourvès in 1989 in France. The board is currently formed by

- Stefan Luding, President
- Cino Viggiani, Vice-president
- Antoinette Tordesillas, Secretary
- Jean-Noël Roux, Treasurer

The committee includes international researchers working on granular materials. The committee meeting takes place every four years during the conference. The members of the committee act as the Scientific Committee for the conference. Here is the full list (at the time of the conference):

- Alam Meheboob, J. N. Centre Adv. Sci. Res.
- Aste Tomaso, University College London
- Bagi Katalin, Budapest Univ. of Technol. & Econ.
- Cambou Bernard, Ecole Centrale de Lyon
- Chang CS, University of Massachusetts Amherst
- Darve Felix, Grenoble INP
- Einav Itai, University of Sydney
- Ghadiri M, University of Leeds
- Gray Nico, University of Manchester
- Guazzelli Elisabeth, Université de Paris
- Hatano Takahiro, Osaka University
- Hayakawa Hisao, Kyoto University
- Herrmann Hans, PMMH, ESPCI
- Hou May, Chinese Academy of Sciences
- Hrenya Christine, University of Colorado Boulder
- Jaeger Heinrich M., University of Chicago
- Jenkins Jim, Cornell University
- Jiang Mingjing, Tongji University
- Kamrin Ken, Massachusetts Institute of Technology
- La Ragione Luigi, Politecnico di Bari
- Liu Mario, University of Tuebingen
- Luding Stefan, University of Twente
- Maeda Kenichi, Nagoya Institute of Technology
- Magnanimo Vanessa, University of Twente
- Makse Hernan, The City University of New York
- Matsushima Takashi, University of Tsukuba
- Mehta Anita, Oxford University
- Melo Francisco, Universidad de Santiago de Chile
- Mujica Nicolás, Universidad de Chile

- Nakagawa Masami, Colorado School of Mines
- Nott Prabhu, Indian Institute of Science
- Pöschel Thorsten, University of Erlangen-Nuremberg
- Pouliquen Olivier, Aix-Marseille Université-CNRS
- Pagnaloni Luis, Universidad Nacional de La Pampa
- Radjai Franck, The University of Montpellier
- Roux Jean-Noel, Inst. Français Sci. et Technol. Transp.
- Schröter Matthias, Friedrich-Alexander Univ. Erlangen
- Shattuck Mark, The City University of New York
- Soto Rodrigo, Universidad de Chile
- Thornton Anthony, University of Twente
- Thornton Colin, University of Birmingham
- Tordesillas Antoinette, University of Melbourne
- Vidales Ana María, Universidad Nacional de San Luis
- Viggiani Gioacchino, Université Grenoble Alpes
- Wyart Matthieu, Ecole Polytechnique Fed. Lausanne
- Yang Runyu, University of New South Wales
- Yu Aibing, Monash University
- Zhao Jidong, Hong Kong Univ. Sci. Tech.
- Zuriguel Iker, University of Navarra

2.2 Local Committee

The local organizing committee of the P&G 2021 conference was composed by a number of colleagues from South America including Argentina, Brazil, Chile, Colombia and Venezuela. Here is the list:

- Maria Alejandra Aguirre, Universidad de Buenos Aires
- Allbens Atman, C. Fed. Educ. Tecnol. Minas Gerais
- Manuel Carlevaro, Inst. Física Líquidos Sist. Biol.
- José Ramón Darías, Universidad Simón Bolívar
- Nicolás Estrada, Universidad de Los Andes
- Ezequiel Ferrero, Centro Atómico Bariloche
- Victoria Ferreyra, Universidad Nacional de La Pampa
- Jason Gallas, Universidade Federal da Paraíba
- Irene Ippolito, Universidad de Buenos Aires
- Marcos Madrid, Inst. Física Líquidos Sist. Biológicos
- Francisco Melo, Universidad de Santiago de Chile
- Nicolás Mujica, Universidad de Chile
- Jose Daniel Muñoz, Universidad Nacional de Colombia
- Luis Pagnaloni (Chair), Univ. Nacional La Pampa
- Alexandre Rosas, Universidade Federal da Paraíba
- Rodrigo Soto, Universidad de Chile
- Ana Vidales, Universidad Nacional de San Luis

3 Invited speakers

The invited talks were selected after a series of consultations and voting within the AEMMG Committee from a large list of proposed candidates. The invited speakers were:

- Meheboob Alam, J. N. Centre Adv. Sci. Res., India
Unified theory for granular and gas-solid suspensions
- Mike Cates, University of Cambridge, UK
Constitutive modeling of time-dependent flows in dense frictional suspensions
- Christine Hrenya, Univ. Colorado Boulder, USA
Tackling fundamental questions in particle flows, courtesy of industry
- Lisa Manning, Syracuse University, USA
Predicting avalanches in granular materials from ‘vibrational’ modes
- Nicolás Mujica, Universidad de Chile, Chile
Tribo-charging effects on granular growth and its relevance for planet formation
- Olivier Pouliquen, Aix-Marseille Univ, CNRS, France
Complex granular flows
- Carlos Santamarina, K. A. Univ., Saudi Arabia
The role of granular materials in the energy challenge
- Anthony Thornton, Univ. Twente, The Netherlands
Multiscale modelling of segregation
- Ana María Vidales, Univ. Nac. San Luis, Argentina
Resuspension processes in a wide range of particle sizes
- Jidong Zhao, Hong Kong Univ. Sci. Tech., Hong Kong
Multiscale modeling of granular media for geomechanics and beyond

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