Graziano Frungieri

Assistant Professor (RTD-A), Chemical Engineering, DISAT, Politecnico di Torino

My research activity deals with the modeling of multiphase disperse flows (colloidal suspensions, Pickering emulsions, particle assembly for drug delivery, particle aggregation and breakup) by CFD, DEM and population balance modeling, and with the modeling of lithium ion batteries and microalgae growth.

Personal details

Birth date	20 January 1988
Birth place	Potenza, Italy
Nationality	Italian
Languages	Italian, English
Email	graziano.frungieri@polito.it
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Current and previous positions

02/2023–to date **Assistant Professor RTD-A / ING-IND24: Principi di Ingegneria Chimica**, *Department of Applied Science and Technology, Multiphase Systems and Chemical Engineering*, Politecnico di Torino.

11/2020–10/2021 **Postdoctoral Researcher**, *Chair of Process System Engineering - TUM School of Life Sciences - Technical University of Munich*, Project: Numerical modelling of Pickering emulsions processing in fluid flow, Scientific advisor: Prof. Heiko Briesen.
The project focuses on the study of the processing of Pickering emulsions in laminar shear and in homogeneous and isotropic turbulence by a population balance model.

11/2020–10/2021 **Postdoctoral Researcher**, *Department of Applied Science and Technology, Politecnico di Torino*, Project: Battery Interface Genome - Materials Acceleration Platform (BIG-MAP), Scientific advisors: Prof. Marco Vanni, Prof. Daniele Marchisio.
The project aims at developing multiscale simulation techniques to study the degradation phenomena occurring in Li-ion batteries.

07/2018–10/2020 **Postdoctoral Researcher**, *Department of Applied Science and Technology, Politecnico di Torino*, Project: Virtual Materials Marketplace (VIMMP), Scientific advisors: Prof. Marco Vanni and Prof. Daniele Marchisio.
The project aims at developing multiscale simulation techniques to address industrially relevant modelling challenges.

Education

11/2014–07/2018 **Ph.D. in Chemical Engineering**, *Politecnico di Torino*, Torino, Italy, *cum laude*.
Thesis title: A novel Monte Carlo - Discrete Element Method approach for the micro-mechanics of colloidal suspensions: An investigation on aggregation and breakup phenomena
Supervisor: Prof. Vanni Marco

11/2016–07/2017 **Guest Ph.D. Student at the department of Chemical Engineering**, *Royal Institute of Technology (KTH)*, Stockholm, Sweden.
Research activity: Modellization of hetero-aggregation phenomena in colloidal suspensions
Supervisor: Prof. Matthäus Bäbler

2011–2014 **Master degree in Chemical Engineering**, *Politecnico di Torino*, Torino, *110/110 with honours*.
Thesis title: Development of a Discrete Element Method for the dynamics of colloidal suspensions
Supervisor: Prof. Vanni Marco

08/2012–02/2013 **Erasmus Mobility Programme**, *Technische Universiteit of Eindhoven TU/e*, Eindhoven, The Netherlands.
Study program: Polymer Physics, Colloid Chemistry, Micro–reactors and Micro–process Tecnology, Process Design

2007–2011 **Bachelor degree in Chemical Engineering**, *Politecnico di Torino*, Torino, Italy, *110/110 with honours*.
Thesis title: Development of sol-gel systems for water and oil repellent finishing of cotton fabrics
Supervisor: Prof. Ferrero Franco

2002-2007 **Diploma at Liceo Scientifico**, *Liceo Scientifico G. Galilei*, Potenza, *100/100 with honours*.

Specialization courses - Post Lauream

03–05/10/2018 **Advanced CFD and Turbulence Modelling targeting HPC**, *Barcelona Supercomputing Center*, Barcellona, Spain.

02–06/07/2018 **Fluid dynamics effects on particle formation in crystallization processes**, *International Center for Mechanical Sciences*, Udine, Italy.

10–15/09/2017 **16th European School on Rheology**, *KU Leuven*, Leuven, Belgium.

14–16/11/2016 **GRICU PhD National School 2016 - Chemical engineering for sustainable production of energy and fine chemicals**, *Gruppo Ricercatori di Ingegneria Chimica dell'Università*, Anacapri, Italy.

18–20/11/2015 **High Performance Molecular Dynamics**, *Cineca*, Bologna.

23–25/02/2015 **Introduction to Parallel Computing with MPI and OpenMP**, *Cineca*, Roma.

Awards and achievements

2021 **Recipient of a TUM Global Postdoc Fellowship awarded by the Technical University of Munich**.
A two-year fellowship-program to boost the academic career of excellent international researchers.

2021 **Featured among the top 15 downloaded articles of *The Canadian Journal of Chemical Engineering* in 2020**.
Frungieri et al., 2020, CFD-DEM investigation of the breakup of fractal agglomerates in an internal mixer, Can. J. Chem. Eng.

2015 **Winner of the Ing. Vittorio De Bernochi award by the Alumni Association of Politecnico di Torino**.
Best graduate master student 2014 in Chemical Engineering

Teaching experience

03/2023–07/2023 **Teaching Assistant**, *Politecnico di Torino*.
Fenomeni di Trasporto/Transport Phenomena (18 hours)

10/2022–12/2022 **Co-holder of the course**, *Technische Universität München*.
Modeling and simulation of disperse systems (20 hours)

10/2022–12/2022 **Co-holder of the course**, *Technische Universität München*.
Scientific Computing with Matlab (20 hours)

04/2022–07/2022 **Co-holder of the course**, *Technische Universität München*.
Scientific Computing with Matlab (20 hours)

03/2021–06/2021 **Teaching assistant**, *Politecnico di Torino*.
Thermodynamics for Chemical Engineering (20 hours)(Prof. Marco Vanni)

03/2020–06/2020 **Teaching assistant**, *Politecnico di Torino*.
Thermodynamics for Chemical Engineering (40 hours) (Prof. Marco Vanni)

10/2018–01/2019 **Teaching assistant**, *Politecnico di Torino*.
Thermodynamics for Material Science (20 hours) (Prof. Ada Ferri)

04/2016–06/2016 **Teaching assistant**, *Politecnico di Torino*.
Computational Fluid Dynamics (20 hours) (Prof. Daniele Marchisio)

03/2013– **Lab assistant (studente borsista)**, *Politecnico di Torino*.
06/2013 Didactic Chemistry Lab for Bachelor students (50 hours)

Peer-reviewed publications

Frungieri, G., Boccardo G., Buffo A., Karimi A., Marchisio D., Vanni M. (2022) Dispersive Mixing in an Internal Mixer by a CFD-DEM Approach, *AIP Journal*, Proceedings of the 36th meeting of the Polymer Processing Society, (accettato, DOI non ancora disponibile), https:

Vasquez Giuliano L., Buffo, A., Vanni, M., Frungieri, G. (2023). Micromechanics and strength of agglomerates produced by spray drying. JCIS Open, 9, 100068. https://doi.org/10.1016/j.jciso.2022.100068

Frungieri, G., Briesen, H. (2023). A population balance model for the flow-induced preparation of Pickering emulsions. *Chemical Engineering Research and Design*, 189, 694-706, (Q1 Journal in Chemical Engineering) doi: https://doi.org/10.1016/j.cherd.2022.11.037

Vasquez Giuliano L., Buffo A., Vanni M., Lanotte A. S., Arima V., Bianco M., Baldassarre F., Frungieri, G. (2022) Response of shear–activated nanotherapeutic particles in a clot obstructed blood vessel by CFD–DEM simulations, *The Canadian Journal of Chemical Engineering*, 100, 3562-3574, IF 2021 (WOS)=2.50, SJR 2021 (SCOPUS)=0.432 (Q2 journal in Chemical Engineering), doi: https://doi.org/10.1002/cjce.24502

Frungieri, G., Carone M., Riggio V., Buffo A., Vanni M., Zanetti M. (2022) Numerical modelling of a lab-scale reactor for microalgae growth, *Chemical Engineering Transactions*, 92, 127-132, SJR 2021 (SCOPUS)=0.254 (Q3 journal in Chemical Engineering), doi: https://doi.org/10.3303/CET2292022

Frungieri, G., Boccardo G., Buffo A., Karimi-Varzaneh A.H., Vanni M. (2022) CFD–DEM characterization and population balance modelling of a dispersive mixing process, *Chemical Engineering Science*, 260, 117859, IF 2021 (WOS)=4.889, SJR 2021 (SCOPUS)=0.87, (Q1 journal in Chemical Engineering), doi: https://doi.org/10.1016/j.ces.2022.117859

Frungieri, G., Vanni M. (2021) Aggregation and breakup of colloidal particle aggregates in shear flow: A combined Monte Carlo - Stokesian dynamics approach, *Powder Technology*, 388, 357-370. doi: https://doi.org/10.1016/j.powtec.2021.04.076

Frungieri, G., Babler M.U., Vanni M. (2020) Shear-induced heteroaggregation of oppositely charged colloidal particles, *Langmuir*, 36, 10739-10749. doi: https://doi.org/10.1021/acs.langmuir.0c01536

Frungieri, G., Boccardo G., Buffo A., Marchisio D., Karimi A., Vanni M. (2020) CFD-DEM investigation of the breakup of fractal agglomerates in an internal mixer, *The Canadian Journal of Chemical Engineering*, 98, 1880-1892. doi: https://doi.org/10.1002/cjce.23773 (Featured among the top 15 downloaded articles of *The Canadian Journal of Chemical Engineering* in 2020.)

Frungieri G., Vanni M. (2017) Shear-induced aggregation of colloidal particles: A comparison between two approaches to the modelling of colloidal interactions, *The Canadian Journal of Chemical Engineering*, 95, 1768-1780. doi: https://doi.org/10.1002/cjce.22843

Conference contributions - Oral presentation

Frungieri, G., Bäbler M., L. Biferale, Lanotte A.S, Breakup of colloidal particle aggregates in simple shear and in a homogeneous isotropic turbulent flow, IUTAM Symposium, From Stokesian suspension dynamics to particulate flows in turbulence, Toulouse, France, 29 August-2 September 2022.

Frungieri, G., Briesen H., Population Balance Modelling of Pickering Emulsions, 7th International Conference on Population Balance Modelling (PBM2022), Lyon, France, 9 May-11 May 2022.

Frungieri G., Carone M., Riggio V., Buffo A., Vanni M, Zanetti M., Numerical modelling of a lab-scale reactor for microalgae growth, International Conference on Biomass (IConBM2022), Naples, Italy, 5 June 2022-8 June 2022.

Frungieri G., Bäbler M., A. S. Lanotte, Fragmentation and stress statistics of inertial particles in homogeneous isotropic turbulence, 33rd Parallel CFD International Conference (ParCFD33), Alba, Italy, 25 May 2022-27 May 2022.

Frungieri G., Boccardo G., Buffo A., Marchisio D., Karimi A., Vanni M., A CFD-DEM investigation of the breakup of fractal agglomerates in a compounding operation, 36th International conference of the polymer processing society (PPS-36), Montreal, Canada, 26 September 2021-29 September 2021.

Frungieri G., Vanni M. Stokesian dynamics simulation of a shear-induced aggregation process, 25th International Congress of Theoretical and Applied Mechanics (ICTAM2021), Milano 22-27 August 2021.

Frungieri G. Multiscale simulation of rubber compounding - Invited speaker at Nanotech France 2021, 24 June 2020.

Frungieri G., Bäbler M., Vanni M., Aggregation and breakup phenomena in solid-liquid disperse systems, online meeting of the Swedish Industrial Association for Multiphase Flows, 20 may 2021 (invited speaker).

Frungieri G. (2019) CFD-DEM investigation of the breakup of carbon-black agglomerates in an internal mixer, 6th Continental Simulation Days, Hannover, Germany, 8-9 October 2019, (invited speaker).

Frungieri G., Bäbler M., Vanni M. (2019) Numerical investigation of the shear-induced hetero-aggregation of oppositely charged particles, 12th European Congress of Chemical Engineering (ECCE12), Florence, Italy, 15-19 September 2019.

Frungieri G., Boccardo G., Vanni M. (2019) Multiscale simulations of industrial problems in an open simulation platform: the compounding of rubber materials as a case study, International Congress on Industrial and Applied Mathematics (ICIAM2019), Valencia, Spain, 15-19 July 2019.

Frungieri G., Boccardo G., Buffo A., Marchisio D., Vanni M. (2019) CFD-DEM investigation of the internal stresses of carbon black agglomerates in a Banbury mixer, GRICU 2019 - Il contributo dell'Ingegneria Chimica Italiana alla sostenibilità globale, Mondello, Italy, 30 June - 3 July 2019.

Frungieri G., Vanni M. (2019) Aggregation efficiency of colloidal clusters by Stokesian Dynamics, International Conference on Multiphase Flow (ICMF2019), Rio de Janeiro, Brasil, 19-24 May 2019.

Frungieri G., Bäbler M., Vanni M. (2017) Numerical investigation of the heteroaggregation of oppositely charged particles, Flowing Matter Conference (FM2017), Porto, Portugal, 23-27 January 2017.

Frungieri G., Vanni M. (2016) Shear-induced aggregation of colloidal particles - A comparison between two different approaches to the modelling of colloidal interactions, GRICU2016 - Gli Orizzonti 2020 dell'Ingegneria Chimica, Anacapri, Italy, 12-14 September 2016.

Frungieri G., Vanni M. (2016) Dynamics of shear-induced aggregation by a combined Monte Carlo - Stokesian Dynamics approach, International Conference on Multiphase Flow (ICMF2016), Florence, Italy, 22-27 May 2016.

Frungieri G., Vanni M. (2015) Dynamics of shear-induced aggregation. A combined Monte Carlo - Stokesian Dynamics approach, 15th Conference of the International Association of Colloid and Interface Scientists (IACIS2015), Mainz, Germany, 24-29 May 2015.

Conference contributions - Poster presentation

Frungieri G., Bäbler M., Vanni M. (2019) Numerical investigation of the heteroaggregation of oppositely charged particles, Flotinc workshop, Institut Jean Lamour, Nancy, France, 28 November 2019 (upon invitation).

Frungieri G., Boccardo G., Buffo A., Marchisio D., Vanni M. (2019) CFD-DEM investigation of the internal stresses of carbon black agglomerates in a Banbury mixer, 12th European Congress of Chemical Engineering (ECCE12), Florence, Italy, 15-19 September 2019.

Frungieri G., Vanni M. (2018) A parallel Monte Carlo - Stokesian Dynamics approach for the shear-induced aggregation of colloidal particles, PBM2018 - 6th International Conference on Population Balance Modelling, Ghent, Belgium, 7-9 May 2018.

Conference contributions - as coauthor

Banetta L., Frungieri G., Marcato A., Boccardo G., Bodoardo S., Marchisio D., Computational modelling of the Solid Electrolyte Interface (SEI) in lithium-ion batteries and its impact on long-term battery aging, GRICU 2022, Ischia, Italy, 3-6 July, 2022.

Vasquez Giuliano L., Frungieri G., Buffo A., Vanni M., CFD-DEM simulations of shear-activated nanotherapeutic particles, GRICU 2022, Ischia, Italy, 3-6 July, 2022.

Vasquez Giuliano L., Frungieri G., Vanni M. Breakup of shear–activated nano-thereapeutics in a microfluidic device by a CFD–Stokesian dynamics approach, 25th International Congress of Theoretical and Applied Mechanics (ICTAM2021), Milano 22-27 August 2021, ISBN: 9788365550316, https://iutam.org/publications/ictam-proceedings/ictam_2020

Altro

Master thesis co-advisor:

- 2021 Federico Benetti, Thesis title: 3D modeling of Li-ion battery by Ansys Fluent.
- 2020 Nicola D'Intinosante, Thesis title: Computational Fluid Dynamics investigation of a Single Screw Extruder: A flow and heat transfer analysis. (Collaborative work with Continental AG)
- 2019 Lorenzo Vasquez Giuliano, Thesis title: Sviluppo di farmaci innovativi per la rimozione di ostruzioni arteriose: modellazione fluidodinamica del processo di attivazione (Collaborative work with CNR Nanotech Lecce)

2020-present: Reviewing activities for: *The Canadian Journal of Chemical Engineering*, *Journal of Environmental Engineering*, *Chemical Engineering Transactions*, *Chemical Engineering Research and Design*, *Polymers*, *Minerals*

2019–present: PhD co-advisor (student: Lorenzo Vasquez), Topic: Numerical investigation of shear-activated nano-theraupetics by CFD and DEM simulations (collaborative work with experimental support from Consiglio Nazionale delle Ricerche CNR-Nanotech, Lecce, Italy).

2019: Chairman of the Particle Technology session at the 12th European Congress of Chemical Engineering (ECCE12), Florence, Italy, 15-19 September 2019.