

Jason Ryan Picardo

Assistant Professor

Department of Chemical Engineering,
Indian Institute of Technology Bombay,
Mumbai, 400076, India

picardo[at]iitb.ac.in; jrpflows[at]gmail.com
<https://www.che.iitb.ac.in/faculty/jason-r-picardo>
Research profiles on Google Scholar and Research Gate



Personal Information

- Date of birth: 5 Dec 1988
- Nationality: Indian

Education

- **PhD in Chemical Engineering** July 2011 - March 2017
Indian Institute of Technology Madras Chennai, TN, India
 - Thesis: Physics of Layered Micro-flows
 - Mentor: Prof. S. Pushpavanam, Department of Chemical Engineering
- **Fulbright-Nehru Fellow** Sep 2015-May 2016
University of Florida Gainesville, Fl, USA
 - Project: Nonlinear pattern selection in interfacial instabilities
 - Mentor: Prof. Ranga Narayanan, Department of Chemical Engineering
- **BTech in Chemical Engineering** Sep 2007 - Apr 2011
VIT University Vellore, TN, India

Positions

- **Assistant Professor** August 2019 - present
Department of Chemical Engineering, Indian Institute of Technology Bombay Mumbai, India
- **Faculty Associate** 2021 - present
International Centre for Theoretical Sciences (TIFR) Bengaluru, India
- **Postdoctoral Fellow** June 2017 - August 2019
International Centre for Theoretical Sciences (TIFR) Bengaluru, India
 - Mentors: Dr. Samriddhi Sankar Ray, Prof. Rama Govindarajan

Professional Experience

- Visitor to **Laboratoire J.A. Dieudonne, Universite Cote d'Azur, Nice, France** (May 2024, Dec 2022, Apr 2019, May 2018)
- Visitor to **Department of Chemical Engineering, University of Florida, USA** (April 2017, Dec 2016)
- Visitor to **Laboratoire FAST, Universite Paris-Sud, Orsay, France** (Mar 2016, Dec 2016)
- Member, **Board of Studies**, Department of Chemical Engineering, **VIT University**, Vellore, India (2021-present).

- Reviewer for journals including Journal of Fluid Mechanics, Physics of Fluids, International Journal of Multiphase Flow, Fluid Dynamics Research, AIChE Journal, and Journal of Engineering Mathematics.

Research Areas

- **Turbulent transport:**
polymers, particles, plankton, flames
- **Instabilities and pattern formation:**
creeping elastic flows, pulmonary mucus dynamics, actomyosin active-flows
- **Multi-scale modelling:**
center-manifold/Lyapunov-Schmidt reduction, weighted-residual methods

Awards

- NASI-Platinum Jubilee Young Scientist Award (2022)
- Fulbright-Nehru Doctoral Research Fellowship (2015-2016)
- IIT Madras Institute Research Award (2015)

Research Grants

- CEFIPRA Collaborative Research Grant (2023-2025)
- DST-SERB Startup Research Grant (2022-2023)
- IIT Bombay IRCC Seed Grant

Educational and Outreach Publications

1. *In the chaos of turbulence, scientists chase glimpses of hidden order*,
S. Mukherjee and **J. R. Picardo**,
The Hindu (e-paper), 13 Dec 2023.

Research Publications

32. *Preserving large-scale features in simulations of elastic turbulence*,
S. R. Yerasi, **J. R. Picardo**, A. Gupta, and D. Vincenzi,
Journal of Fluid Mechanics, 1000, A37 (2024).
31. *Polymers in turbulence: stretching statistics and the role of extreme strain-rate fluctuations*,
J. R. Picardo, E. L. C. VI M. Plan and D. Vincenzi,
Journal of Fluid Mechanics, 969, A24 (2023).
30. *Small-scale intermittency of premixed turbulent flames*,
A. Roy, **J. R. Picardo**, B. Emerson, T. C. Lieuwen and R. I. Sujith,
Journal of Fluid Mechanics, 957, A21 (2023).
29. *Thin-gap averaging of variable-viscosity flows: application to thermoviscous fingering*,
D. S. Pillai, **J.R. Picardo**, R. Narayanan,
arXiv:2201.10045
28. *Sedimenting elastic filaments in turbulent flows*,
R. Singh, **J.R. Picardo**, S.S. Ray,
Physical Review Fluids, 7, 084502 (2022).
27. *Polymer scission in turbulent flows*,
D. Vincenzi, T. Watanabe, S.S. Ray, **J.R. Picardo**,
Journal of Fluid Mechanics, 912, A18 (2021).

26. *Dynamics of a long chain in turbulent flows: Impact of vortices*,
J.R. Picardo, R. Singh, S.S. Ray, D. Vincenzi,
Philosophical Transactions of the Royal Society A, 378, 20190405 (2020).
25. *Fluid dynamics in clouds: the sum of its parts*,
S. Ravichandran, **J.R. Picardo**, S.S. Ray, R. Govindarajan,
Encyclopedia of Complexity and Systems Science, Springer (2020).
24. *Lagrangian irreversibility and Eulerian dissipation in fully-developed turbulence*,
J.R. Picardo, A. Bhatnagar, S.S. Ray,
Physical Review Fluids (Rapid), 5, 042601(R) (2020).
23. *Elasto-inertial chains in a two-dimensional turbulent flow*,
R. Singh, M. Gupta, **J.R. Picardo**, D. Vincenzi, S.S. Ray,
Physical Review E, 101, 053105 (2020).
22. *Understanding droplet collisions through a model flow: Insights from a Burgers vortex*,
L. Agasthya, **J.R. Picardo**, R. Govindarajan, S.S. Ray,
Physical Review E, 99, 063107 (2019).
21. *Flow structures govern particle collisions in turbulence*,
J.R. Picardo, L. Agasthya, R. Govindarajan, S.S. Ray,
Physical Review Fluids (Rapid), 4, 032601(R) (2019).
20. *Preferential sampling of elastic chains in turbulent flows*,
J.R. Picardo, D. Vincenzi, N. Pal, S.S. Ray,
Physical Review Letters, 121, 244501 (2018).
19. *Sliding instability of draining fluid films*,
G. Dietze, **J.R. Picardo**, R. Narayanan,
Journal of Fluid Mechanics, 857, 111-141 (2018).
18. *Layered two-phase flow in microchannels with arbitrary interface-wall contact angles*,
R. Dandekar, **J.R. Picardo**, S. Pushpavanam,
Chemical Engineering Science, 192, 1058-1070 (2018).
17. *Interfacial pattern selection in defiance of linear growth*,
J.R. Picardo, R. Narayanan,
Journal of Fluid Mechanics, 829, 345-363 (2017).
16. *Numerical study of enhanced mixing in pressure-driven flows in microchannels using a spatially periodic electric field*,
T. Krishnaveni, T. Renganathan, **J. R. Picardo**, S. Pushpavanam,
Physical Review E, 96(3), 033117 (2017).
15. *Solutal-Marangoni instability in layered two-phase flows*,
J.R. Picardo, Radhakrishna, T. G., S. Pushpavanam,
Journal of Fluid Mechanics, 793, 280-315 (2016).
14. *Low-dimensional modeling of transport and reactions in two-phase stratified flow*,
J.R. Picardo, S. Pushpavanam,
Industrial and Engineering Chemistry Research, 54(42), 10481-10496 (2015).
13. *Centrifugal instability of stratified two-phase flow in a curved channel*,
J.R. Picardo, P. Garg, S. Pushpavanam,
Physics of Fluids, 27, 054106 (2015).
12. *Laterally stratified flow in a curved microchannel*,
J.R. Picardo, S. Pushpavanam,
International Journal of Multiphase Flow, 75, 39–53 (2015).

11. *Modeling Extraction in Microchannels with Stratified Flow: Channel Geometry, Flow Configuration and Marangoni Stresses*,
J.R. Picardo, Radhakrishna T.G., Anil B. Vir, Sundari Ramji, S. Pushpavanam,
Indian Chemical Engineer, 57(3-4), 322-358 (2015).
10. *Chaotic mixing in a planar, curved channel using periodic slip*,
P. Garg, **J.R. Picardo** and S. Pushpavanam,
Physics of Fluids, 27, 032004 (2015).
9. *Understanding the Shape of Ant Craters: A Continuum Model*,
J.R. Picardo and S. Pushpavanam,
Bulletin of Mathematical Biology, 77, 470–487 (2015).
8. *Vertically stratified two-phase flow in a curved channel: Insights from a domain perturbation analysis*,
P. Garg, **J.R. Picardo** and S. Pushpavanam,
Physics of Fluids, 26, 073604 (2014).
7. *Shifting and breakup instabilities of squeezed elliptic jets*,
D. S. Pillai, **J.R. Picardo** and S. Pushpavanam,
International Journal of Multiphase Flow, 67, 189–199 (2014).
6. *Performance Comparison of Liquid-Liquid Extraction in Parallel Microflows*,
A.B. Vir, A.S. Fabiyan, **J.R. Picardo** and S. Pushpavanam,
Industrial and Engineering Chemistry Research, 53, 19, 8171-8181 (2014).
5. *Holdup characteristics of two-phase parallel microflows*,
A.B. Vir, S.R. Kulkarni, **J.R. Picardo**, A. Sahu, S. Pushpavanam,
Microfluidics and Nanofluidics, 16, 1057-1067 (2014).
4. *Core-annular two-phase flow in a gently curved circular channel*,
J.R. Picardo and S. Pushpavanam,
AIChE Journal, 59, 12, 4871-4886 (2013).
3. *On the conditional superiority of counter-current over co-current extraction in microchannels*,
J.R. Picardo, S. Pushpavanam,
Microfluidics and Nanofluidics, 15, 5, 701-713 (2013).
2. *The Merkel equation revisited: A novel method to compute the packed height of a cooling tower*,
J.R. Picardo and J.E. Variyar,
Energy Conversion and Management, 57, 167-172 (2012).
1. *Establishing the efficacy of the cleansing action of Tropical Evergreens: A modeling analysis of Asia's largest lignite based power plant*,
J.R. Picardo and S. Ghosh,
Environment Asia, 4(2), 1-8 (2011).

Mentorship

- **PhD Students**

- Swarnaditya Hazra, 2021-present
- Aditya Gupta, 2022-present

- **Masters Students**

- Lokahith Agasthya, 2017-2018
- Ketan Teppalwar, 2019-2021
- Ashutosh Kumar Singh, 2020-present
- Madhu Kiran Golla (Dual-degree), 2021-2022

- Damini Shrikant Kale, 2021-2022
- Jitendra Paliya, 2022-present
- **Undergraduate Students**
 - Piyush Garg, 2014-2015
 - Rajat Dandekar, 2016-2017
 - Achintya Kunj Goyal, 2022-present

Invited Talks

- *How linear relaxation triggers nonlinear waves in an active fluid*
Seminar @ Laboratoire Jean-Alexandre Dieudonne, **Universite Cote D’Azur**, Nice, France, May 2024
- *Stretch, coil, break: the turbulent voyage of a polymer*
Seminar @ Department of Mechanical Engineering, **NIT Calicut**, Kozhikode, Feb 2024
Workshop on Soft and living matter, ICTS-TIFR, Bangalore, Oct 2023
- *Simulating turbulence in viscoelastic polymer solutions*
DST Workshop on Computational methods in applied mathematics and chemical engineering, ICT Mumbai, July 2023
- *Complex creeping flows*
Seminar @ Department of Mechanical Engineering, **Monash University**, Australia, May 2023
- *Transport and sedimentation of elastic filaments in turbulent flows*
Seminar @ IRPHE, **Aix Marseille University**, France, Dec 2022
- *Fluttering flames, intermittency, and the KPZ equation* (video link)
BIRS Workshop: Stochastic Approaches to Turbulence in Hydrodynamical Equations, Banff, Canada, Mar 2022
- *Polymer scission in turbulent flows*
e-Seminar @ Dept. of Chemical Engineering, **IIT Gandhinagar**, India, Feb 2022
Online Turbulence Seminar Series, Oct 2021 (video link)
Soft Matter Young Investigator e-Meet, Dec 2020
- *Lagrangian dynamics of elastic filaments in turbulent flows* (video link)
NSM Workshop on HPC in CFD, Indian Institute of Technology Madras, Dec 2020
- *Elastic chains, inertial particles and turbulent flow structures*
Seminar @ **Nordic Institute for Theoretical Physics**, Sweden, May 2019
Seminar @ Dipartimento di Fisica, **Universita di Roma Tor Vergata**, Italy, May 2019
Seminar @ Department of Physics, **Indian Institute of Science**, Bangalore, India, March 2019
- *Pattern formation in interfacial flows*
Seminar @ Centre for Nano Science and Engineering, **Indian Institute of Science**, Bangalore, India, March 2019
- *Patterned flows: from thin films to turbulence*
Seminar @ Department of Chemical Engineering, **Indian Institute of Technology Kanpur**, India, Feb 2019
- *Mixing in microchannels via chaotic advection and interfacial instability*
Seminar @ Laboratoire Jean-Alexandre Dieudonne, **Universite Nice Sophia-Antipolis**, Nice, France, May 2018
- *Nonlinear mechano-chemical oscillations in a model actomyosin cortex*
IUTAM Symposium on Dynamics and Stability of Interfaces, University of Florida, USA, May 2018
- *Interfacial pattern selection in defiance of linear growth*
Journal of Fluid Mechanics Symposium, **Indian Institute of Technology Madras**, India, Dec 2017

- *Soluble surfactants in layered two-phase flow*
Seminar @ Department of Chemical Engineering, **Birla Institute of Technology Goa**, Goa, India, Feb 2017
- *Breakup of bilayer films: Insights into pattern selection*
Center for Soft Matter Research Seminar Series, Indian Institute of Technology Madras, Chennai, India, Nov 2016
- *Marangoni instabilities and pattern selection*
Seminar @ Engineering Mechanics Unit, **Jawaharlal Nehru Centre for Advanced Scientific Research**, Bangalore, India, Oct 2016
- *Centrifugal instability and vortices in layered flow through curved microchannels*
Seminar @ Institut Jean Le Rond d'Alembert, **Universite Pierre et Marie Curie**, Paris, France, March 2016
- *Analysis of microscale extraction in layered flows*
Seminar @ Institute of Electronics, Micro-electronics and Nanotechnology, **Universite de Lille**, France, March 2016
- *Solutal-Marangoni instability in layered two-phase flows*
Seminar @ Laboratoire FAST, **Universite Paris-Sud**, Orsay, France, March 2016
Seminar @ Nonlinear Physical Chemistry Unit, **Universite Libre de Brussels**, Brussels, Belgium, February 2016

Major Conference Presentations

- *How turnover triggers nonlinear waves in the active actomyosin cortex*
COMPFLU 2023, Indian Institute of Technology Madras, Dec 2023
- *Lagrangian irreversibility and intermittent dissipation in turbulence*
Euromech Colloquium 620: Extreme dissipation and intermittency in turbulence, TU Delft (online), May 2021.
- *Polymer scission in turbulent flows*
COMPFLU-Online 2020, Indian Institute of Technology Bombay (online), Dec 2020
- *The voyage of an elastic chain in a turbulent flow*
COMPFLU 2019, Indian Institute of Science Education and Research, Bhopal, India, Dec 2019
- *Preferential Sampling of Elastic Chains in Turbulent Flows*
IUTAM Symposium on Dynamics of Complex Fluids and Interfaces, Indian Institute of Technology Kanpur, India, Dec 2018
- *Sliding instability of draining fluid films*
COMPFLU 2018, Indian Institute of Technology Roorkee, India, Dec 2018
- *Collision-coalescence driven growth of droplets in turbulent air*
COMPFLU 2017, Indian Institute of Technology Madras, Chennai, India, Dec 2017
- *Instability and Breakup of Interacting Fluid Interfaces*
8th Conference of the International Marangoni Association, Bad Honnef, Germany, Jun 2016
- *Solutal Marangoni Instability in Stratified Two-Phase Flows*
68th Annual Meeting of the APS Division of Fluid Dynamics, Boston, Nov 2015
- *Low-Dimensional Modeling of Reactions and Transport in Stratified Microflows*
AIChE Annual Meeting, Salt Lake, Utah, Nov 2015.
- *Slow-Manifold Order Reduction of Reaction-Diffusion Equations with Dirichlet Boundary Conditions*
AIChE Annual Meeting, Salt Lake, Utah, Nov 2015
- *Low-dimensional Modeling of Reactions and Transport in Stratified Microflows*
Mathematics in Chemical Kinetics and Engineering (MaCKiE 2015), University of Ghent, Belgium, Jul 2015

- *Stability of two phase Poiseuille flow between infinite cylinders*
Bifurcations and Instabilities in Fluid Dynamics (BIFD), Technion, Haifa, Israel, Jul 2013
- *On the unobvious choice between co-current and counter-current extraction in microchannels*
Mathematics in Chemical Kinetics and Engineering (MaCKiE 2013), Indian Institute of Technology Madras, Chennai, India, Feb 2013

Public Outreach and Educational Talks

- *Academic Ethics*
Guest lecture in an undergraduate Ethics and Values course
VIT University, Vellore (conducted online) Dec 2020
- *Patterns in Fluids: from Thin Films to Turbulence*
Target audience: under-graduate and graduate students
Short term training program on Modelling and Simulation of Micro and Macro Multiphase Systems
National Institute of Technology Karnataka, Surathkal, India, Jan 2019
- *Mathematics of Ant Behaviour*
Target audience: university students and faculty, as well as the general public
Fulbright Alumni Chapter Pecha-Kucha Evening, University of Florida, Florida, USA, Jan 2016
- *Higher Education and Research Opportunities in Chemical Engineering*
Target audience: BTech students in the final and pre-final years
VIT University Vellore, Vellore, India, Feb 2015
- *Confrontation with Chaos*
Target audience: general public
Science Club Meeting, IIT Madras, Chennai, India, July 2012

Teaching Experience

- **Modelling Stochastic and Turbulent Transport**
Graduate elective course;
Spring 2024
- **Process Fluid Mechanics**
Undergraduate core course;
Fall 2023; Fall 2024
- **Advanced Transport Phenomena**
Undergraduate (honours) course; Lectures available on Youtube
Fall 2020; Fall 2021; Fall 2022
- **Communication Skills**
Postgraduate (pass-fail) course
Spring 2020; Spring 2021; Spring 2022
- **Multiphase Flows: Analytical Solutions and Stability Analysis**
Graduate course; 7/30 lectures delivered; NPTEL: <http://nptel.ac.in/courses/103106113/1>