Lionel VINCENT

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RESEARCH INTERESTS & SKILLS

- **Experimental Fluid Dynamics** with various fluids and live microorganisms, at the micro and macro scales; experiments design and fabrication; micro-fabrication; microbiology. Flow Imaging using PIV and PTV techniques.

- **Physical modeling** using various programming languages: MATLAB, C/C++ (with graphic library Allegro), HTML, Maple, VBA. Designed and used codes for solving: dynamics of liquid bridges, dynamics of two-dimensional objects falling in fluid, dynamics of splash-induced cavity and the associated splash.

- **Image analysis & tracking**, and data processing using ImageJ and MATLAB. Designed and used codes for 3D trajectory and state reconstruction of disks and thin plates, and tracking arbitrary objects in two dimensions.

EDUCATION

- **Ph.D.** in Physics of Fluids and Fluid Mechanics 12/2013
  IRPHE laboratory, Aix-Marseille University, FR

- **M.S.** in Mechanics, Energy and Engineering, specialty: Fluid Mechanics 08/2010
  Université Joseph Fourier, Grenoble, France

- **M. Eng.** in Hydraulics and Mechanics, specialty: Mechanics and Energy 08/2010
  Institut Nat. Polytechnique, Grenoble, France

- **B. Eng.** in Hydraulics and Mechanics 08/2008
  Institut Nat. Polytechnique, Grenoble, France

- Intensive preparatory classes in Physics and Chemistry (PCSI, PC*) 2005-2007
  Lycée Champollion, Grenoble, France

- Baccalauréat S (Sciences) with major in Maths 07/2005

RESEARCH EXPERIENCE

Post-doctoral scholar, AME, University of Southern California 2014 -2018

at the macro scale:

- *Descent dynamics of passively falling bio-inspired flyers*
- *Water entry problems: forces generated by a diving wedge, and shape of splash*

at the micro scale:

- *Rheotaxis of V. fischeri applied to the squid-vibrio symbiosis and interplay between biofilms and flow in porous medium*

Advisor: Eva Kanso

Research Assistant, IRPHE, Aix-Marseille University, France 2010-2013
- *Dynamics and break-up of stretched liquid bridges*

Advisors: Laurent Duchemin & Stéphane Le Dizès

M.S. student, IRPHE, Aix-Marseille University, France 2010
- *Experimental study of a highly-accelerated viscous fluid layer around a cylinder*, with application to stone wool manufacturing

Advisors: Mickaël Le Bars & Laurent Duchemin

B.S. student, Warwick University, Fluid Dynamics Group, UK 2008
- *Theoretical and experimental study of a free-falling water curtain*

Advisor: Petr Denissenko

PEER-REVIEWED JOURNAL PUBLICATIONS

[1] **L. Vincent**, L. Duchemin, S. Le Dizès, "Forced Dynamics of a short viscous liquid bridge" *Journal of Fluid Mechanics* **761**, 220-2240 (2014)
https://doi.org/10.1017/jfm.2014.622

[2] **L. Vincent**, L. Duchemin, E. Villermaux, "*Remnants from fast liquid withdrawal*" *Physics of Fluids* **26**, 031701 (2014)
https://doi.org/10.1063/1.4867496

[3] L. Duchemin, S. Le Dizès, **L. Vincent** and E. Villermaux, "Self-similar impulsive capillary waves on a ligament", *Physics of Fluids* **27**, 051704 (2015)
https://doi.org/10.1063/1.4921321

[4] **L. Vincent**, W. S. Shambaugh, E. Kanso, "Hole stabilize freely falling coins" *Journal of Fluid Mechanics* **801**, 250-252 (2016)
https://doi.org/10.1017/jfm.2016.432

[5] S. Rubol, D. Tonina, **L. Vincent**, W. Basham, E. Kanso, D. G. Capone, K. H. Nealson "Seeing through porous media: interstitial flow unveiled", *Hydrological Processes* **32**(3), 402-407(2018)
http://doi.org/10.1002/hyp.11425

[6] **L. Vincent**, T. Xiao, D. Yohann, S. Jung, and E. Kanso, "Dynamics of water entry", *Journal of Fluid Mechanics* **846**, 508-535 (2018)
https://doi.org/10.1017/jfm.2018.273
Research featured on the Viterbi School and AME Department websites **:**
https://viterbischool.usc.edu/news/2017/11/making-a-splash/

[7] T. Lam, **L. Vincent**, E. Kanso, "Passive flight in density-stratified fluid", *Journal of Fluid Mechanics,* **860**, 200-223 (2019)
https://doi.org/10.1017/jfm.2018.862

JOURNAL PUBLICATIONS IN PREPARATION

8. T. Lam, **L. Vincent**, E. Kanso, "Stratification Reduces Flutter and Enhances Dispersion of Freely Falling Discs", *under review (Journal of Fluid Mechanics)*

9. **L. Vincent**, M. Zheng, E. Kanso, "Enhanced flight of heterogeneously-flexible wings", *in preparation*

10. **L. Vincent**, M. Zheng, E. Kanso, "Optimal winglet design of tumbling wings", *in preparation*

11. **L. Vincent**, Y. Liu, E. Kanso, "Shape matters: optimal geometric designs of tumbling wings", *in preparation*

12. A. Battacharjee, **L. Vincent**, J. Nawroth, E. Kanso "aggregation behavior of V. fischeri in vortices", *in preparation*

REFEREED PROCEEDINGS

[i] **L. Vincent**, L. Duchemin, S. Le Dizès et E. Villermaux "Dynamique de ligaments fortement étirés" *Congrès Français de Mécanique 2013 (CFM 2013)*, 2013

[ii] **L. Vincent**, L. Duchemin et S. Le Dizès, "Dynamics of a slowly elongated viscous liquid bridge", *9th European Fluid Mechanics Conference (EFMC 9*), 2013

[iii] **L. Vincent** et E. Kanso, "Under the microscope cover slip: spontaneous flows and bacterial behavior" *Chaos, Complexity and Transport: Proceedings of the CCT'15 Conference, pp. 83-103,* 2015

COMMUNICATIONS

Diving wedges (seminar)
LEGI, Nov 24, **2018**, Grenoble, France

Optimal design of auto-rotating wings (talk)
71th annual DFD meeting, Nov 18-20, **2018**, Los Angeles, CA, USA

Flexible auto-rotating wings (talk)
SoCal Fluids XII symposium, Apr 14, **2018,** Los Angeles, CA

Performance of flexible auto-rotating wings (talk)
APS March Meeting, Mar 7, **2018,** Los Angeles, CA

Diving wedges and tumbling wings (talk)
USC AME Department Seminar, Feb 27, **2018,** Los Angeles, CA

Diving wedges (talk)
70th annual DFD meeting, November 19-21, **2017**, Denver, CO

Slamming and slapping: The Hidden Beauty of Water Entry talk)
USC Post-doctoral symposium, May 22, **2017**, San Diego, CA, USA

Aerodynamic shapes of two-dimensional splashes (talk)
SoCal Fluids XI symposium, April 22, **2017,** San Diego, CA

Aerodynamic shapes of two-dimensional splashes (talk)
Slamming and slapping: the story of the Diving Wedge (video submission)
https://youtu.be/zfIzaPA9RhE
69th annual DFD meeting, November 20-22, **2016,** Portland, OR

Enhanced flight characteristics by heterogeneous auto-rotating wings (talk)
68h annual DFD meeting, November 22-24, **2015,** Boston, MA

Bacteria Response to External Flows (talk/seminar)
LadHyX, June 10, **2015,** Palaiseau, France

Bacteria Response to External Flows (talk)
SoCal Fluids IX symposium, April 18, **2015,** San Diego, CA

Bacteria in structured flows (poster)
Microscale Ocean Biophysics, January 11-16, **2015,** Aspen, CO

Make a wish: Falling coins in water (talk)
67th annual DFD meeting, November 23-25, **2014,** San Francisco, CA

Falling coins in water (talk)
Aux rencontres de Peyresq 2014, June 2-6, **2014,** Peyresq, France

Bacterial suspensions: a brief overview of recent experiments (talk)
SoCal Fluids VIII symposium at UCLA, April 12, **2014,** Los Angeles, CA

Ligament breakup without surface tension (talk)
66th annual DFD meeting, November 24-26, **2013,** Pittsburgh, PA

Dynamique de ligament fortement étirés (talk)
Congrès Francais de Mecanique 2013, August 26-30, **2013,** Bordeaux, France

Dynamics of strongly stretched ligaments (talk)
GDR Ruissellement et films cisaillés, March 27-29, **2013,** Aussois, France

Ponts liquides : étirement et rupture (talk)
GDR Ruissellement et films cisaillés, September 26-28, **2012,** Fréjus, France

Dynamics of a slowly elongated viscous liquid bridge (talk)
9th European Fluid Mechanics Conference, September 9-13, **2012,** Roma, Italia

Dynamique d'un pont liquide lentement étiré (talk)
Aux Rencontres de Peyresq "Dynamique, non-linéarités et complexité dans les phénomènes naturels terrestres", June 3-8, Peyresq, **2011,** France

Dynamique de jets visqueux accélérés (talk)
GDR Ruissellement et films cisaillés, March 8-9, **2011,** Paris, France

Dynamique de ligaments visqueux accélérés (talk)
GDR Ruissellement et films cisaillés, January 11-12, **2011,** Paris, France

EDITORIAL DUTIES & ACADEMIC ENGAGEMENT

Judge for the 2nd annual showcase of the Senior Design Projects	Dec 2018
Judge for the USC Undergraduate Research Symposium	April 2018
Session chair at the SoCal Fluids Symposium	April 2018
Referee for *Journal of Fluid and Structures* (editor: S. Michelin)	2017

PROFESSIONAL SOCIETY MEMBERSHIPS

American Physical Society	since 2013

ORGANIZATIONAL AND LEADERSHIP SKILLS

Lab manager of Dr. Kanso's experimental lab since 2014 **:**

- Design, manufacture and operate experimental setups, from scratch.
- Negotiation, purchase, and maintenance of equipment (microscope, high-resolution camera, water tanks, etc.); p-card holder.
- Management of authorizations (biosafety level 1 and laser safety) and supervision of lab inspections, supervision of lab tours, Masters and PhD preview days, and outreach events; student training.

Collaborative work with research teams and companies
Active collaborations with more than 11 researchers from 6 universities:

- S. Jung (Virginia Tech), and Dean F. Sotiropoulos, T. Truong, D. Angelidis (Stony Brook University), on the force generated by diving birds.
- E. Ruby, M. McFall-Ngai (University of Hawaii), J. Nawroth (Emulate, Inc.) and Scott Fraser lab (USC), on the rheotaxis of V. fischeri in microfluidics environments.
- D. Tonina (University of Idaho), and S. Rubol, K. H. Nealson (USC) on the interplay between flow and biofilm in transparent porous media.

TEACHING EXPERIENCE

- **Research Assistant Professor** for AME 309: Dynamics of Fluids (4 units – 60h). Basics of Fluid dynamics and Water Rocket Design project — Fall 2018
- **Teaching Assistant** for AME 453: two 1.5h lectures and Q&A sessions on Newtonian Mechanics and dynamical systems — 2014
- **Teaching Assistant** for undergraduate students: Thermodynamics (48+32h) and VBA Programming (48h) Institut Universtaire d'Aix-Marseille, France. — 2011-2013

MENTORED STUDENTS AND TEACHERS

PhD students

- **Try Lam** – graduated in August 2018 — Jan 2015 – Aug 2018
  project: *Falling disks in stratified fluids*

Masters students (USC)

- **Yucen Liu** — Mar 2016 – May 2018
  project: *Optimal geometry of rigid auto-rotating wings*
- **Tingben Xiao** — Sep – Dec 2016
  project: *Impact force of a diving wedge*
- **Elaine Wu** — Feb – Dec 2016
  project: *Wake signature of a towed cylinder*
- **Lorenzo Kurstermann** — Mar – Dec 2014
  project: *Wake signature of a towed cylinder*

Undergraduate students

- **Zeyad Zakr** (Imperial College, London) — since July 2018
  project: *flexible divers*
- **Chenchen Huang** (USC) — since June 2018
  project: *flexible filament*
- **Lisa Maillard** (ESPCI, Paris) — May – Aug 2018
  project: *flexible settling disks in water*
- **Mathieu Le Dizès** (French Air Force Academy) — Feb - June 2018
  project: *On the performance of tumbling wings*
- **Daniel Yohann** (USC) — Apr 2016 – May 2017
  project: *Impact force of a diving wedge*
- **Hilina Gudeta** (USC). — Jun – Aug 2016
  project: *Experimental study of confined Faraday waves*
- **Jesus H Castellanos Aguirre** (University of Mexico) — Jun – Aug 2016
  project: *Experimental study of confined Faraday waves*
- **Min Zheng** (USC) — Mar 2015 - Jul 2016
  project: *Flight performance of flexible auto-rotating wings*
- **Scott Shambaugh** (USC) — Jan 2014 – May 2015
  project: *Falling dynamics of punched disks*

Hosted 3 AME 441 (Senior Design projects) groups in the Fall 2018; Hosting one more in the Spring (AME 441B).

High-school students : Adam Kuo, Alison Bartkowski
High-school Teachers: David, Patricia and Trenton, Nadine and Antonio

OUTREACH

- **Viterbi AME STEM Spotlight 2014 & 2017 (**Open House for **high-school students):** In charge of design, manufacturing and supervision of **hands-on**, didactic and visual experiments illustrating our lab's research activities. Examples: visualization the flow around fidgets spinners, stroboscopic effect with a water jet under oscillation. Over 370 students attended in 2017, and over 100 in 2017. **Featured on USC news:**
  http://news.usc.edu/130497/high-school-students-get-a-firsthand-feel-for-what-its-like-to-be-an-engineer/
  https://viterbischool.usc.edu/news/2017/10/high-school-students-attend-ame-stem-spotlight/

- **USC Viterbi RET Program 2016, 2017, and 2018:** Hosted one (2016) and two (2017 and 2018) high-school teachers for summer programs aimed at introducing them to laboratory research. We set-up with the teachers hands-on projects using cameraphones, fidget spinners, pen laser, smoke, image processing and image-based tracking (using Python) specifically designed to engage students.

- **USC Viterbi SHINE 2015:** supervision of one high-school student with a summer project in the lab involving tracking.

- **USC Viterbi SHINE 2018:** open-house for the 33 SHINE student with presentation and interactive demos, in collaboration with Spedding's lab.

- **Science Popularization Comics Project (2012):** As part of my PhD training, I wrote and drew comic strips (in French) about various everyday phenomena that can be explained with physics. Preview (about oceanic tides): http://www-bcf.usc.edu/~lionelvi/tides.html

CIVIC ENGAGEMENT

Volunteer for Union Station Homeless services, Pasadena since 2017

LANGUAGES

French: Mother tongue **; English**: Fluent (CEFR C1 Level) **; Spanish**: Basic level

HOBBIES

Sports: Mountain biking, hiking, trekking, climbing, gliding (licensed since 2005)
Others: Photography, singing, reading