# SYLVIE LORENTE

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## Education

1992 B.S. (Engineer's Diploma), Civil Engineering, specialty: energy and buildings, environmental engineering, INSA Toulouse, France (INSA = National Institute of Applied Sciences).
1992 M.S. (Diploma of Advanced Studies, DEA), Civil Engineering, INSA Toulouse.
1996 Doctorate in Civil Engineering, INSA Toulouse.
2005 Habilitation à Diriger les Recherches, Université Paul Sabatier, Toulouse (07/10/2005)

## Professional Experience

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| Fall 2019 | College of Engineering Chair in Mechanical Engineering, Villanova University, USA. |
| 2017 – 2020 | Hung Hing-Ying Distinguished Visiting Professorship in Science and Technology, Hong Kong University, Hong Kong. |
| 2016 – 2019 | Vice-President for Corporate Relations, Director of the Foundation, INSA Toulouse. |
| 2015 – 2020 | Honorary Professor, Shandong Academy of Sciences, China. |
| 2015 – present | Professor (Exceptional class), INSA Toulouse. |
| 2014 – 2015 | Adjunct Professor, Pontificia Universidad Catolica, Santiago, Chile. |
| 2011 – present | Extraordinary Professor, University of Pretoria, South Africa. |
| 2010 – 2018 | Visiting Chair Professor of Eng., Hong Kong Polytechnic Univ., Hong Kong. |
| 2009 – 2015 | Professor (1ère classe), INSA Toulouse. |
| 2006 – 2009 | Full Professor, INSA Toulouse. |
| 2006 – present | Adjunct Professor, Duke University, USA |
| 1997 – 2006 | Associate Professor (Maitre de Conférences), INSA Toulouse. |
| 1995 – 1997 | Assistant Professor, INSA Toulouse. |
| 1992 – 1995 | Doctoral Candidate, INSA Toulouse. |

**Research Indicators: h-index = 38** (Scopus) and **48** (GoogleScholar), sum of the times cited: 6653 (14443, GoogleScholar)

- **7** books
- **10** book chapters
- **207** peer-reviewed international journal papers
- **2** patents
- **73** peer-reviewed conference papers
- **24** keynote papers
- **62** international invited short courses, summer schools, seminars or conferences
- **6** workshop organizations (or co-)
- **44** international conference committees

## Advising and co-advising

24 (+ 3 in progress) PhD students, 13 MS students, 5 Post-doctoral fellows.

## Honors and Awards

- Academy of Europe, member, 2019.
- Knight of the French Order of National Merit, French Government, May 2015.
- PROSE Award, American Association of Publishers, for the book *Design with Constructal Theory*, 5 Feb. 2009.
- Knight of the French Order of Academic Palms, Ministry of National Education, France, Nov. 2008.
- James P. Hartnett Memorial Award, International Center for Heat and Mass Transfer, American Society of Mechanical Engineers International, Seattle (Washington, USA), November 2007.
- Intelligent Optimal Design Prize, CADLM, Paris (France), October 2006.
- Bergles-Rohsenow Young Investigator in Heat Transfer Award, American Society of Mechanical Engineers International, Orlando (Florida, USA), November 2005.
- Edward F. Obert Award, American Society of Mechanical Engineers International, Anaheim (California, USA), November 2004.
- Research award, Navy Research Office (USA), International Conference Design & Nature II, Rhodes (Greece), June 2004.
- Best paper award, XIII School Seminar Physical Principles of Experimental and Mathematical Simulation of Heat and Mass Transfer and Gas Dynamics in Power Plants, Saint Petersburg (Russia), May 2001.

## Company board

Technical Advisory Board of General Compression Co., Newton, MA, USA (2010-2015).

## Reviewer

International Journal of Heat and Mass Transfer, Journal of Porous Media, International Journal of Thermal Sciences, Energy, Journal of Physics D: Applied Physics, Physica A, Journal of the Royal Society Interface, International Journal of Exergy, Journal of Experimental Biology, Journal of Theoretical Biology, European Journal of Applied Physiology, Cement and Concrete Research, Revue Européenne de Génie Civil, Construction and Building Materials, Materials Letters, Journal of Hazardous Materials, International Journal of Mechanical Sciences, Recent Patents on Mechanical Engineering, Journal of Electronic Packaging, Geomorphology, Chemical Engineering Science.

## Editor

International Communications in Heat and Mass Transfer, Elsevier, since July 2019.

## Editorial Board

- Energy and Buildings, Elsevier, since January 2016.
- Applied Thermal Engineering, Elsevier, since April 2016.
- International Journal of Heat and Technology, IIETA, since April 2017.
- Heat Transfer, Wiley, since September 2018.
- Energies, MDPI, since August 2020.
- International Journal of Heat and Mass Transfer, Elsevier, since December 2020.

## Interviews

Science & Vie (France), and Prism (Am. Soc. Engineering Education): constructal theory
Les Echos, Industrie Technologies, RTL, France Info, Science & Vie : smart materials (self cooling).

## Keynotes/Plenary lectures

1. Maximal heat transfer density: optimal distribution of discrete heat sources on vertical walls in channels and enclosures with natural convection, *Int. Thermal Science Seminar*, Bled (Slovenia), June 2004.
2. Freedom vs. performance, and the evolutionary development of multi-scale hierarchical flow structures, *Second International Conference on Applied Thermodynamics*, Istanbul (Turkey), May 2005.
3. Constructal theory of energy-system and environment flow configurations, *First Int. Green Energy Conference*, Waterloo (Canada), June 2005.
4. Constructal theory and its relevance to Green Energy, *Second International Green Energy*

*Conference*, Oshawa (Canada), June 2006.

5. Vascularized materials: designed porous media for self-healing and self-cooling, *2nd Int. Conf on Porous Media and its applications in Science and Engineering*, Kauai (USA),17-22 June 2007.
6. Vascularized materials as designed porous media, *Int. Exergy, Energy and Environment Symposium (IEEES-3)*, Evora (Portugal), 1-5 July 2007.
7. Vascularized smart materials with tree and grid flow architectures, *Int. Symposium on Transport Phenomena* (ISTP 18), Daejon (South Korea), 27-30 August 2007.
8. Design with constructal theory: vascularized and distributed energy systems, *Int. Conf. On Heat Transfer, Fluid Mechanics and Thermodynamics* (HEFAT 6), Pretoria (South Africa) 30 June- 2 July 2008.
9. Constructal theory and design of vascular structures, *10th Electronics Packaging Technology Conf.* (EPTC), Singapore, 9-12 December 2008.
10. Global distributed energy systems, *The Ravage of the Planet, 2nd Int. Conference on the Management of Natural Resources, Sustainable Development and Ecological Hazards*, Gordon's Bay (South Africa), 15-17 December 2009.
11. Application of thermoporometry to evaluate the mesoporosity of cement pastes, *3rd International Conference on Porous Media and its Applications in Science, engineering and Industry*, Montecatini (Italie), 20-25 June 2010.
12. Few Large and Many Small: Hierarchy in Movement on Earth, Fifth International Conference on *Design and Nature 2010*, Pisa, Italy, 28-30 June 2010.
13. Tree-shaped designs for fluid flow and heat transfer, *International Workshop on Hydrology: Nature & Engineering*, Sultan Qaboos University, Muscat (Oman), 20-21 March 2011.
14. Vascular smart structures, *International Workshop on Hydrology: Nature & Engineering*, Sultan Qaboos University, Muscat (Oman), 20-21 March 2011.
15. Control of flow and mass transfer through porous media, *World Water Day*, Sultan Qaboos University, Muscat (Oman), 22 March 2011.
16. Gas diffusion in cement-based materials: from experiments to modeling of porous architecture, *7th International Conference on Diffusion in Solids and Liquids*, Algarve (Portugal), 26-30 June 2011.
17. Eco Design and Constructal Theory, *XI ENCAC*, Buzios (Brasil), 17-19 August 2011.
18. Constructal design for a sustainable world, *2nd Asian-US-European Thermophysics Conference*, Hong Kong, Jan. 2012.
19. Design with Constructal Theory, recent advances, *Shandong Academy of Sciences,* Jinan (China), August 2015.
20. *William Mong Distinguished Lecture*, The city: live organism with design and sustainability from principle, *Hong Kong University*, 24 May 2016.
21. *NSF Workshop,* Constructal Theory after 20 Years of Exploration and What the Future Holds, Villanova University, Pennsylvania (USA), April 2018.

22. *XXV Latin American conference on Transplant, STALyC,* The constructal law, the law behind natural design, and its applications in the engineering of organs, Merida (Mexico), 23-26 October 2019.
23. *HEFAT Conference, Amsterdam, July 2020, postponed.*
24. 8th International Conference on Heat Transfer and Fluid Flow (HTFF'21), Prague (Czech Republic) August 02-04, 2021, postponed to 2022.

## Invited Short Courses

1. International Summer School on Energy Conversion, Conservation and Environmental Impact, Ovidius University, Constantza (Romania) 21-30 July 2000.
2. International Summer School on Heat Transfer in Porous Media, Ovidius University, Neptun (Romania), 25 July-3 August 2001.
3. International Summer School on Porous and Complex Flow Structures in Modern Technologies, Evora University, Evora (Portugal), 17-21 June 2002.
4. NATO Advanced Study Institute : Emerging Technologies in Porous Media, Neptun, (Romania), 9-20 June 2003.
5. International Summer School on Thermodynamic Optimization and Constructal Design, Yildiz University, Istanbul (Turkey), 19-24 July 2004.
6. Along with Constructal Theory (Autour de la Théorie Constructale), University of Lausanne, Faculté des Géosciences et Environnement, Lausanne (Suisse), 25-29 October 2004.
7. Constructal Theory of the Generation of Optimal Flow Configurations, under Air Force National Laboratory (USA), University La Sapienza, Roma (Italy), 17-18 March 2005.
8. Invited Course on Constructal Design and Complex Flow Structures, Memorial University, St John's, Terre-Neuve (Canada), 21-23 September 2005.
9. Constructal Theory of Social Dynamics, Int. Seminar, Duke University, Durham, NC, USA, 3-5 April 2006.
10. First Int. Symposium on Constructal Tree-shaped Flow Architectures, Jiaotong Univ., Shanghai (Chine), 16-17 October 2006.
11. Constructal Theory and Design in Nature and Engineering, Univ. of Pretoria (South Africa), March 2007.
12. NATO Advanced Research Workshop on Constructal Human Dynamics, Security and Sustainability, Evora (Portugal), 20-23 May 2008.
13. Course on Design with Constructal Theory, Helsinki University of Technology, Helsinki (Finland), September 25-28, 2009.
14. Course on Constructal Theory and Design, KFUPM, Dhahran (Saudi Arabia), May 9-10, 2010.
15. Course on Design with Constructal Theory, AFRL, Dayton (Ohio), June 3-5, 2010.

16. Design with Constructal Theory, Pontificia Universidad Catolica, Santiago (Chili), March 2015.
17. Course on Design with Constructal Theory, Principles and Applications, UNAM (Universidad Nacional Autónoma de México), Sept. 2019.

## Invited Seminars and Conferences

1. Heat transfer through walls with air-filled vertical cavities, Int. Conf. On Efficiency, Comfort, Energy Preservation and Environmental Protection, Bucharest (Romania), 28 Nov. – 2 Dec. 2000.
2. Heat losses through building walls with closed, open and deformable cavities, Forschungszentrum Karlsruhe (Germany), Jan. 2001.
3. Distribution d'un écoulement à travers un domaine fixe. Application à l'hydraulique urbaine, Nouvelles Méthodes en Thermodynamique, Journée de la Société Française des Thermiciens, Paris, April 2001.
4. Thermal performance of wall elements when the mechanical stiffness is constrained, Int. Conf. On Efficiency, Comfort, Energy Preservation and Environmental Protection, Bucharest (Romania), 28-30 Nov. 2001.
5. Optimization of tree-shaped flow structures: are both thermal and flow resistance minimizations necessary? Modern Developments in Thermal Sciences, Galati (Romania), 9-10 April 2003.
6. Tree-shaped flow structures for human scales and small scales applications, Symposium on Shape and Structure in Engineering and Nature, Evora University (Portugal), October 2003.
7. Réseaux dendritiques pour application au transfert de fluide à échelle humaine et petites échelles, New Applications of Shape Optimization, Department Génie Mathématique et Modélisation, INSA Toulouse, March 2004.
8. Constructal tree-shaped networks, International Symposium on Thermal and Fluid Sciences, Gabrovo (Bulgaria), April 2004.
9. Two-objective optimization and robustness, Design and Nature Conference, Rhodes (Greece), June 2004.
10. Tree-shaped networks for fluid flow, Conference on Thresholds and Pattern Dynamics, Perth (Australia), July 2005.
11. Constructal theory of tree-shaped flow systems, Géométries multi-échelle, théorie constructale et exergie, Séminaire de la Société Française de Thermique, Nancy (France), March 2006.
12. Vascularized materials as designed porous media, Faculty of Engineering Distinguished lecture Series, University of Hong Kong, Hong Kong, October 2007.
13. Constructal transport through porous media, ERA (Engineering in Relation with Academy) Short Course, Lawrence Livermore National Laboratory, Livermore, CA, USA, March 2008.

14. Vascular and distributed energy systems, Int. Workshop Shape and Thermodynamics, Florence (Italy), 25-26 Sept. 2008.
15. Constructal Seminar, Int. Institute of Water and Environment Engineering, Ouagadougou (Burkina Faso), 9-10 March 2009.
16. Constructal Theory for the design of smart materials, Suranaree University of Technology, (Thailand), June 2009.
17. Vascular architecture for the cooling of smart materials, Kanazawa University (Japan), Oct. 2009.
18. Constructal Theory and Vascularization, 3rd Southern Conference on Computational Modeling, Rio Grande (Brazil), Nov. 2009.
19. Design with Constructal Theory, Vascularization, Hong-Kong Polytechnic University, Hong-Kong, Jan. 2010.
20. Seminar on Constructal Theory, Int. Institute of Water and Environment Engineering, Ouagadougou (Burkina Faso), 22-23 March 2010.
21. Distributed energy systems on the landscape; few large and many small, Hong-Kong Polytechnic University (Hong-Kong), Sept. 2010.
22. Workshop on Hydrology: Nature and Engineering, Muscat (Oman), 20-21 March 2011.
23. World Water Day, Muscat (Oman), 22 March 2011.
24. Constructal Theory of Water Management, Hong-Kong Polytechnic University (Hong-Kong), April 2011.
25. Eco-Design and Constructal Theory, School of Architecture Rio de Janeiro, Brazil, August 2011.
26. Eco-Design and Constructal Theory, School of Architecture Juiz de Fora, Brazil, August 2011.
27. Théorie constructale, applications multi-échelles, LIMSI, Orsay, Oct. 2011.
28. Constructal Theory and the Flow of Talent workshop, Muscat (Oman), 11-12 Feb. 2012.
29. Constructal Theory today, M.E. Department, Hong-Kong Polytechnic University (Hong-Kong), March 2012.
30. Constructal Design of Energy systems, National Renewable Energy Laboratory (NREL), Golden, USA, April 2012.
31. Constructal Law and Design, application to Constructions, ARUP Company, London (UK), May 2013.
32. Constructal Law, recent applications in Engineering, Pontificia Universidad Catolica, Santiago (Chili), Nov. 2013.
33. Theorizing Globalization, Duke University (USA), Feb. 2015.
34. The city: live organism with design and sustainability from principle, EPFL (Switzerland), April 2015.

35. Constructal design for underground heat exchangers, electrokinetic remediation of contaminated soil and water supply networks, University of Curitiba (Brazil), Dec. 2015.
36. Constructal design for underground heat exchangers, electrokinetic remediation of contaminated soil and water supply networks, University of Porto Alegre (Brazil), 18 Dec. 2015.
37. Design with Constructal theory, recent advances, Hong Kong Polytechnic University (Hong Kong), March 2016.
38. The City: forms and flows, Princeton University (USA), Feb. 2017.
39. The Constructal law as an approach to address energy efficiency in the urban fabric, Federal Univ. Rio Grande do Sul (Brazil), August 2017.
40. The Constructal law as an approach to address energy efficiency in the urban fabric, Unisinos Univ. (Brazil), August 2017.
41. The Constructal law of design, from engineering to nature, Symposium on Mechanobiology in Biomimetics, UNAM, Mexico, Nov. 2018.
42. Thermal engineering for design of sustainable living, Villanova University (USA), Jan. 2019.
43. La loi constructale et ses applications en ingénierie, Société des Ingénieurs et Scientifiques de France IESF, Journées Nationales de l'Ingénierie 2019, Lille, France, March 2019.
44. Thermal engineering for design of sustainable living, City University, Hong Kong, May 2019.
45. *XXV Latin American conference on Transplant, STALyC,* Microfluidics for organs on a chip, Merida (Mexico), 23-26 October 2019.

## Workshop and Conference Organization (or co-)

1. Ionic transfer through cement-based materials, International Workshop, Toulouse (France), 2 days January 2006. Director.
2. Advanced Research Workshop, OTAN, Constructal Human Dynamics, Security and Sustainability, Evora (Portugal), 20-23 May 2008. Co-director.
3. Constructal Law Conference, Porto Alegre (Brazil), 1-2 December 2011. Co-director.
4. Constructal Law Conference, Nanjing (China), 14-15 October 2013. Co-director.
5. Constructal Law Conference, Bucharest (Romania), 15-16 May 2017. Co-director.
6. Constructal Law and Second Law Conference, Porto Alegre (Brazil), 11-13 March 2019. Co-director.

## Member of Scientific and/or Organizing Conference Committees

1. First International Conference on Applications of Porous Media, Djerba (Tunisia), June 2002.
2. First International Exergy, Energy and Environment Symposium, Izmir (Turkey), July 2003.

3. Second International Conference on Applications of Porous Media, Evora (Portugal), May 2004.
4. Second International Thermal Science Seminar, Bled (Slovénia), June 2004.
5. The First Cappadocia Mechanical Engineering Symposium, Nigde (Turkey), July 2004.
6. Second International Conference on Applied Thermodynamics, Istanbul (Turkey), May 2005.
7. 14th International Conference On Thermal Engineering and Thermogrammetry, Budapest (Hungary), June 2005.
8. Third International Conference on Applications of Porous Media, Marrakech (Marocco), 29 May-3 June 2006.
9. 20th ECOS (Efficiency, Costs, optimization, Simulation and Environmental Impact of Energy Systems), Padova (Italy), 2007.
10. Second Int. Conf. On Porous Media and its Applications in Science, Hawaï (USA), 18-22 June 2007.
11. Third International Exergy, Energy and Environment Symposium, Evora (Portugal), July 2007.
12. 19th International Symposium on Transport Phenomena, Reykjavik (Iceland), 17-20 August 2008.
13. 20th International Symposium on Transport Phenomena, Victoria (Canada), 3-9 July 2009.
14. First International Conference on Optimization using Exergy-Based Methods and Computational Fluid Dynamics, Berlin (Germany), 20-23 Oct. 2009.
15. Int. Conference on Computational Methods for Energy Engineering and Environment, ICCM3E, Sousse (Tunisia), 20-22 Nov. 2009.
16. Third Int. Conf. On Porous Media and its Applications in Science, Il Ciocco (Italy), 20-24 June 2010.
17. 23th ECOS (Efficiency, Costs, optimization, Simulation and Environmental Impact of Energy Systems), Lausanne (Switzerland), 14-17 June 2010.
18. 21th International Symposium on Transport Phenomena, Kaohsiung (Taiwan), 2-5 Nov. 2010.
19. The Global Conference on Global Warming, GCGW 2011, Lisbon (Portugal), 9-14 July 2011.
20. 1st International Symposium on Cement-based Materials for Nuclear Wastes, Avignon (France), 11-14 Oct. 2011.
21. 22nd International Symposium on Transport Phenomena, Delft (Holland), 8-11 Nov. 2011.
22. The 2nd Asian-US-European Thermophysics Conference - Thermal Science for Sustainable World, Hong Kong (China), 3-6 Jan. 2012.
23. Fourth Int. Conf. On Porous Media and its Applications in Science, Postdam (Germany), 17-22 June 2012.
24. Design and Nature, La Coruna (Spain), 11-13 June 2012.

25. 23rd International Symposium on Transport Phenomena, Auckland (New Zeland), 19-22 Nov. 2012.
26. 5th International Conference on Applications of Porous Media, Cluj-Napoca (Romania), 25-28 August 2013.
27. 2nd International Symposium on Cement-based Materials for Nuclear Wastes, Nuwcem, Avignon (France), 3-6 June 2014.
28. Fifth International Conference on Porous Media and its Applications in Science, Engineering and Industry, Hawaii (USA) June 22-27, 2014.
29. International Conference on Solar Energy & Building, Sousse (Tunisia), 20-21 January 2015.
30. International Conference on Energy Systems and Developments 2015 (ICESD 2015), 11-12 February 2015.
31. 7th International Exergy, Energy and Environment Symposium, Valenciennes (France), 27-30 April 2015.
32. Constructal Law & Second Law Conference, Parma (Italy), 18-19 May 2015.
33. Constructal Law & Second Law Conference, Bucharest (Romania), 15-16 May 2017.
34. Int. Conf. of Energy Harvesting, Storage, and Transfer, EHST'17, Toronto (Canada), 22-23 August 2017.
35. International Conference on Composite Materials & Renewable Energy Applications, Istanbul (Turkey), 2-4 April 2017.
36. International Technology Congress, Pune (India), 28-29 Dec. 2017.
37. 2nd Int. Conf. of Energy Harvesting, Storage, and Transfer, EHST'18, Niagara Falls (Canada), 7-9 June 2018.
38. 3rd AIGE/IIETA International Conference and 12th AIGE Conference 2018, Energy Conversion, Management, Recovery, Saving, Storage and Renewable Systems, Reggio Calabria Messina, 14-16 June 2018.
39. 3rd Int. Conf. of Energy Harvesting, Storage, and Transfer, EHST'19, Ottawa (Canada), 17-19 June 2019.
40. 4th Int. Conf. of Energy Harvesting, Storage, and Transfer, EHST'20, June 2020.
41. 5th Int. Conf. of Energy Harvesting, Storage, and Transfer, EHST'20, June 2021.
42. 15th Int. Conf. on Heat Transfer, Fluid Mechanics and Thermodynamics, HEFAT, Virtual, July 2021.
43. 8th International Conference on Heat Transfer and Fluid Flow (HTFF'21), Prague (Czech Republic) August 02-04, 2021.
44. 6th Int. Conf. of Energy Harvesting, Storage, and Transfer, EHST'20, June 2022.

## Advising (or co-) of MS Students

1. F. Moucadel, Etude expérimentale de la convection naturelle dans un mur de brique en terre cuite constitué d'alvéoles verticales, 1993.
2. E. Massias, Etude thermique et dynamique des écoulements d'air dans des cavités à grand rapport d'allongement, 1994.
3. S. Ginestet, Ecoulements de convection naturelle dans des alvéoles ; influence du facteur de forme, 1996.
4. C. Toulouse, Modélisation des phénomènes de convection naturelle à l'intérieur d'un double vitrage courbé, 1996.
5. K. Choukairy, Etude en site réel d'un système de protection contre les surchauffes solaires, 1999.
6. B. Lacarrière, Etude numérique de l'écoulement secondaire en cavité fermée à grand rapport d'allongement, 1999.
7. A.Khitab, Diffusion des espèces ioniques à travers un matériau inerte, 2002.
8. A. Adjlane, Mesure du coefficient de diffusion sous champ électrique à travers des céramiques, 2004.
9. P.L. Dao, Contrôle par voie électrocinétique du transfert d'un agent agressif dans un milieu poreux réactif, 2006.
10. E. Cetkin, The Natural Emergence of Vascular Design with Turbulent Flow, 2010.
11. S. Ziaei, The constructal evolution of the cross sections of jets toward the round shape, 2013.
12. M. Alalaimi, Effect of size on ground coupled heat pump performance, 2013.
13. D. Paludetto, Smart Thermal Grid, 2015.

## Advising (or co-) of PhD Students

1. B. Lartigue, Contribution à l'étude thermique et dynamique des doubles vitrages. Approche numérique et expérimentale, 1999, co-advised.
2. F. Frizon, Décontamination électrocinétique des milieux poreux. Etude expérimentale et modélisation appliquées au césium dans les matériaux cimentaires, 2003, co-advised.
3. W. Wechsatol, Constructal dendritic trees for heating and cooling, 2005, co-advised.
4. A. Khitab, Modélisation des transferts ioniques dans les milieux poreux saturés : application à la pénétration des chlorures à travers les matériaux cimentaires, 2005, co-advised.
5. T.S. Nguyen, Influence de la nature du liant et de la température sur le transport des chlorures dans les matériaux cimentaires, 2006, co-advised.
6. K.M. Wang, Vascularized networks for the cooling of smart materials, 2008, co-advised.
7. S. Kim, Vascularized networks for self-healing materials, 2008, co-advised.
8. J. Lee, Constructal design of vascular materials, 2008, co-advised.

9. J. Auger, Mise au point et développement d'un procédé d'aide à la déconstruction des ouvrages en béton armé, 2009, co-advised.
10. T.H. Vu, Caractérisation de la phase solide et transferts de gaz dans les milieux poreux insaturés. Etude expérimentale et modélisation appliquées à la diffusion de l'hydrogène dans les matériaux cimentaires, 2009.
11. Y. Kim, Design with Constructal Theory: Steam Generators, Turbines and Heat Exchangers, 2010, co-advised.
12. L. Fernandez, Transposition en architecture des connaissances d'ingénierie environnementale et des savoirs relatifs au choix des matériaux, 2010, co-advised.
13. C. Boher, Etude expérimentale et modélisation de la diffusion gazeuse à travers les milieux poreux partiellement saturés en eau. Application aux verres Vycor, géopolymères et pâtes de ciment CEM-V, 2012.
14. H. Mercado, Transferts aqueux à travers les matériaux cimentaires partiellement saturés, 2012.
15. T.Wattez, Diffusion de l'eau tritiée sous champ électrique, 2013.
16. E. Cerkin, Smart materials and Constructal Theory, 2013, co-advised.
17. M. Fontenelle, La ventilation naturelle dans la réhabilitation de bâtiments de bureaux en milieu urbain dense : défis et potentiel, 2016, co-advised.
18. S. Ziaei, Design of Latent Thermal Energy Storage Systems, 2016, co-advised.
19. M. Alailami, Constructal Design of Energy Systems, 2016, co-advised.
20. S. Rhida, Urban Heat Island mitigation strategies in an arid climate. Is outdoor thermal comfort reachable?, 2017, co-advised.
21. A. Almerbati, The method of Constructal design in heat exchangers, 2018, co-advised.
22. Q. Nguyen, Transport phenomena through porous materials for radioactive waste storage, 2018.
23. B. Seng, Étude expérimentale et numérique du comportement hygrothermique de blocs préfabriqués en béton de chanvre, 2018, co-advised.
24. R. Bui, Towards a realistic estimation of the walls moisture buffering in an occupied room, 2018, co-advised.
25. M. Mosa, Toward an efficient design of ceiling radiantpanels for cooling applications in buildings, Nov. 2019, co-advised.
26. A.Malley, Design of thermochemical energy storage reactors: a Constructal approach. Dec. 2019, advised.

<u>In progress</u>

1. M. Cezard, Thermally active systems for buildings air conditioning
2. X. Zhang, Capillary flow networks
3. S. Gungor, Cooling of EV batteries

Advisor of a 'Habilitation à Diriger les Recherches': F. Frizon (March 2012), S. Ginestet (Nov. 2017)

## Advising of postdoctoral fellows

1. P. Bégué-Escaffit : Chloride electrokinetic transfer, 2006-2008.
2. D. Voinitchi, Interactions porous solid phase/chlorides, 2005-2006.
3. A. Koonsrisuk, Urban heat islands, 2012.
4. H. Mercado, Temperature impact on diffusion through non-saturated porous media, 2012-2013.
5. T.Wattez, Constructal Architectures through porous media, 2014-2015.
6. A. Malley, Thermochemical Energy Storage design, since Jan. 2020, funding: Ministry of Research, France.
7. A. Torres, Liver blood architecture, since Nov. 2020, funding: Conacyt, Mexico.

## Member of PhD dissertation committees

1. Zhang Xiaofen, Numerical and Experimental study of natural convection heat transfer from a discrete heater array in an incline/rotating liquid filled enclosure, Nanyang Technological University (Singapore), July 2002.
2. Chen Xuyang, Direct Liquid Cooling of Stacked Multichip Modules, Nanyang Technological University (Singapore), April 2004.
3. Alex K. da Silva, Constructal multi-scale heat exchangers, Duke University (USA), June 2005.
4. C. Barrot Lattes, Développement de méthodes expérimentales pour l'analyse des écoulements de liquides dans les microcanaux, INSA (Toulouse), May 2007.
5. Atit Koonsrisuk, Analysis of flow in solar chimney for an optimal design purpose, Suranaree University of Technology (Thailand), June 2009.
6. A. Ben Fraj, Transferts dans les bétons non saturés : influence des laitiers et de l'endommagement mécanique, Université de Nantes, December 2009.
7. M.K. Bourbatache, Modélisation des transferts des ions chlorures dans les matériaux cimentaires par homogénéisation périodique, Université de La Rochelle, December 2009.
8. Xia Liang, Study on the heat and mass transfer taking place in a direct expansion air cooling and dehumidification coil, Hong Kong Polytechnic University (Hong Kong), Janv. 2010.
9. Cosimo Marinosci, Empirical validation and modelling of a naturally ventilated rainscreen façade building, University of Bologna (Italy), March 2011.
10. Li Haiwang, Mixed electroosmotic-pressure driven multi-fluid flow in microchannels, Nanyang Technological University (Singapore), Sept. 2011.

11. Yan Pan, Control and Design for a Multi-evaporator Air Conditioning (MEAC) System, Hong Kong Polytechnic University (Hong Kong), June 2012.
12. Xu Bin, Single and Two-Phase Heat Transfer in Microchannels, Nanyang Technological University (Singapore), July 2012.
13. Xie Jinlong, Experimental and theoretical studies of spray cooling for high power electronics, Nanyang Technological University (Singapore), October 2013.
14. Bouthaina Larbi, Caractérisation du transport diffusif dans les matériaux cimentaires : influence de la microstructure des mortiers, Univ. Paris Est (France), October 2013.
15. Huang Yi, Non-Newtonian fluids in microchannels, Nanyang Technological University (Singapore), October 2015.
16. E. X. Barreto, Design constructal de caminhos com alta condutividade termica para resfriamento de corpos geradores de calor considerando a resistencia de contado, University of Porto Alegre (Brazil), December 2015.
17. Feng Huicheng, Investigation of induced charge electrokinetic phenomena, Nanyang Technological University (Singapour), December 2015.
18. Zineb Bajja, Influence de la microstructure sur le transport diffusif des pâtes, mortiers et bétons à base de CEM I avec ajout de fumée de silice, Univ. Paris Est (France), December 2016.
19. Patrick Ribeiro, Analyse entropique et multi-échelle pour la fatigue et la rupture thermomécanique, Uni ; Paris Nanterre (France), November 2017.
20. Larysa Okhrimenko, Stockage d'énergie thermique par un composite zéolithe/$MgSO_4$ : étude thermocinétique du système $MgSO_4$-$H_2O$ et étude expérimentale des composites. Ecole des Mines Saint Etienne (France), Jan. 2018.
21. Felipe Valenzuela, An investigation on the design and performance of two-phase cooling systems for data center electronic systems, Villanova University, Aug. 2020.
22. Ji Lang, Concussive Brain Injury: From Egg Yolk to Artificial Brain to Real Brain, Villanova University, Apr. 2021.

## Grants

**~ 2 M€ in France, and 2.2 M$ in the USA**

*Please note in the following that for the French grants 1/ PI salary is not included, and 2/ overheads are 11%.*

1. VINCI ENERGY, Thermally active building systems, 2018-2021, 220 k€.
2. ANR (French National Research Agency), on Thermo-chemical energy storage, 1.48 M€ for 3 labs, 500 k€ for my group.
3. ANDRA, Electrical Double Layer and diffusion through porous media, 2014-2017, 362 k€.

4. National Science Foundation, EAGER: heat networks and energy & environment design, 2014-2015, 150 k$ (P.I. : A. Bejan, Duke University).
5. ANDRA, Impact of the temperature level on diffusion through non-saturated porous media, 2012-2013, 65 k€.
6. French Embassy, Urban Heat Islands, 2012, 10 k€.
7. NREL (National Renewable Energy Laboratory), Optimal design of residential energy systems using constructal theory, 2010-2013, 630 k$ (P.I. : A. Bejan, Duke University).
8. Air Force Office of Scientific Research, CTair: constructal tree structures for mechanical strength and cooling of aircrafts, 2010-2013, 317 k$ (P.I. : A. Bejan, Duke University).
9. CEA, Tritium diffusivity, 2010-2013, 103.5 k€.
10. CEA, Hydrogen diffusion through non-saturated porous media, 2009-2012, 103.5 k€.
11. ANDRA, Aqueous transfer through non-saturated porous media, 2009-2011, 281 k€.
12. Air Force Office of Scientific Research, Constructal technology for thermal management of aircraft, 2006-2008, 249 k$ (P.I. : A. Bejan, Duke University).
13. CEA, Hydrogen transfer through porous media, 2006-2009, 103.5 k€.
14. Vinci, Optimal deconstruction of reinforced concrete, 2006-2009, 142.5 k€.
15. US Air Force, Multidisciplinary University Research Initiative. Microvascular Autonomic Composites, 2006-2008, 878 k$ (P.I. : A. Bejan Duke University).
16. AUF (Agence Universitaire de la Francophonie), Transferts de chlorure sous champ électrique, 2005-2006, 20k€.
17. ANDRA, Diffusion under an electrical field, 2005-2006, 64 k€.
18. Colzani Architect, Thermal behavior of heated walls, 1998, 10 kF.
19. Société Isoroy, Thermal conductivity measurements, 1998-1999, 45 kF.

## Scientific Collaborations

NREL (National Renewable Energy Lab., USA), AFRL (Air Force Research Lab., USA), General Compression (USA), Doosan Heavy Industry (South Korea), Vinci, CEA (Grenoble, Marcoule, Cadarache), Andra.

Duke University (USA), Hong Kong Polytechnic Univ. (Hong Kong), Univ. of Pretoria (South Africa), Univ. of Evora (Portugal), Univ. Fédérale Rio de Janeiro (Brazil), Federal Univ. of Rio Grande do Sul (Brazil), Federal Univ. of Parana (Brazil) , KFUPM (Saoudi Arabia).

International Energy Agency, ECES Annex 31 (Energy storage with energy efficient buildings and districts).

## Teaching

Constructal Theory and Design, ME 5155, Senior elective, Spring 2020.

Thermal Energy Storage, ME 7140, Fall 2020.

Convection Heat Transfer, ME 8120, Spring 2021.

Lead instructor and coordinator, INSA Toulouse, until May 2019:

- Fluid Mechanics and Transfer (3rd year Civil and M.E. students)
- Thermodynamics (4th year Civil Eng. students, HVAC specialization)
- Transfer through Porous Media (MS in Civil Eng.)

Co-instructor

- Constructal Theory and Design (ME 438, Undergrad. Course, ME Dpt, Duke University, USA)), until 2016.
- Design with Constructal Theory (Grad. Course, ME Dpt, University of Pretoria, South Africa), since 2010

In the past, I taught Heat Transfer, Urban hydraulics, HVAC, Acoustics, Strength of materials, Physical properties of Materials.

## Professional Service:

- Member of the Foundation for Science and Technology, Portugal, Engineering panel, 2021.
- Member of the Research Council of Austria, COMET panel, 2020.
- 2 NSF review panels (Fluid Dynamics, Particulate and Multiphase Processes), 2020.
- Member of the steering committee Villanova University Institute Climate Justice Sustainability, 2020.
- Member of the Strategic planning committee on PhD students reporting, Villanova College of Engineering, academic year 2020-21.
- Chair of the Thermo-Fluid cluster, Villanova ME Department, since August 2020.
- Member of various ME Department committees (recruitment: 1, promotion: 3)
- **V.P. for Corporate Relations and Director of the INSA Foundation, 2016 to mid-2019, fundraised: 1.8 M€.**
- Member of the European Research Council, Brussels (Belgium) since 2014.
- Member of the Research Grant Council, Hong Kong, since 2013.
- **Founder and Director of Ô Talents, the outreach program at INSA (Cordée de la Réussite): I developed partnerships between selected (disadvantaged) high school students and INSA, 2005-2015.**
- Member of the National Council of Universities, 60th section (2000-2006, vice-president from 2004 to 2006, 2012-2019).
- Member of the ANR (National Research French Agency) committee "Sustainable Buildings and Cities".

- President of a laboratory evaluation committee for AERES (French Agency for Evaluation of Research).
- Chief advisor and administrator of each class of 4$^{th}$-year students enrolled in the Civil Engineering Department, INSA, University of Toulouse.
- Elected member of the Departmental Council, Department of Civil Engineering, INSA, University of Toulouse.
- Elected member of the Scientific Council, INSA, University of Toulouse.
- Head or member of French search committees in several French universities and engineering schools (ass. professor and professor levels)