

Stanford



Javier Urzay

Sr Research Engineer, Mechanical Engineering

Bio

BIO

Dr. Javier Urzay was a Sr. Research Aerospace Engineer at the Stanford Center for Turbulence Research, where he worked for more than a decade. He was also the Associate Director of the DoE/NNSA Stanford PSAAP-III Center -- a 40+ persons team dedicated to supercomputing of laser ignition of cryogenic rocket propellants. His technical field of expertise is high-speed, chemically reacting, multi-phase turbulent flow physics and their engineering applications to aeronautics and astronautics, including rocket propulsion, supersonic combustion, and hypersonic aerothermodynamics of air and space flight systems. He taught the Stanford graduate classes ME356 Hypersonic Aerothermodynamics (he created this class), ME451C Compressible Turbulence, ME355 Compressible Flows, and ME471 Turbulent Combustion. He received his B.Sc./M.Sc. (Ingeniero Superior) degree in Mechanical Engineering in 2005 from the Carlos III University of Madrid (Spain), and his M.Sc. and Ph.D. degrees in Aerospace Engineering in 2006 and 2010 from the University of California San Diego (UCSD) working on theoretical combustion physics and fluid mechanics. At UCSD he taught the undergraduate class MAE180A Spacecraft Guidance (Astrodynamics). He is also a graduate of USAF Basic Military Training School and USAF Officer Training School. Dr. Javier Urzay is currently the Chief of the Combustion Devices Branch in the US Space Force, Rocket Propulsion Division at the Air Force Research Laboratory, Edwards AFB. Dr. Urzay is also an Air Force Reserve Commissioned Officer (Developmental Engineer), core member of the US Air Force Reserve Hypersonics Team, and is currently assigned to the Space Systems Integration Office in the USSF Space Systems Command at Los Angeles SFB, where he works on hypersonic missile defense.

ACADEMIC APPOINTMENTS

- Sr Research Engineer, Mechanical Engineering

PROFESSIONAL EDUCATION

- Ph.D. Aerospace Engineer, University of California San Diego (UCSD) , Theoretical Combustion Physics and Fluid Mechanics (Adviser: Prof. Forman Williams) (2010)
- M.Sc. Aerospace Engineer, University of California San Diego (UCSD) , Fluid Mechanics, Physical Gasdynamics and Applied Mathematics (2006)
- B.Sc.+M.Sc. Mechanical Engineer, Carlos III University of Madrid (Spain) , Fluid Mechanics, Propulsion and Energy (2005)

LINKS

- Research Website: <http://web.stanford.edu/~jurzay/>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

High-speed, chemically reacting, multi-phase flow physics
and their engineering applications to aeronautics and astronautics,
including rocket propulsion, supersonic combustion, and hypersonic aerothermodynamics

of air and space flight systems.

Teaching

COURSES

2020-21

- Hypersonic Aerothermodynamics: ME 356 (Spr)

2019-20

- Hypersonic Aerothermodynamics: ME 356 (Spr)

Publications

PUBLICATIONS

- **Transcritical diffuse-interface hydrodynamics of propellants in high-pressure combustors of chemical propulsion systems** *PROGRESS IN ENERGY AND COMBUSTION SCIENCE*
Jofre, L., Urzay, J.
2021; 82
- **Engineering aspects of hypersonic turbulent flows at suborbital enthalpies** *Annual Research Briefs, Center for Turbulence Research, Stanford University*
Urzay, J., Di Renzo, M.
2020: 7-32
- **Aerodynamic generation of electric fields in turbulence laden with charged inertial particles** *NATURE COMMUNICATIONS*
Di Renzo, M., Urzay, J.
2018; 9: 1676
- **Supersonic combustion in air-breathing propulsion systems for hypersonic flight** *ANNUAL REVIEW OF FLUID MECHANICS*
Urzay, J.
2018; 50: 593-627
- **Thermochemical effects on hypersonic shock waves interacting with weak turbulence** *PHYSICS OF FLUIDS*
Huete, C., Cuadra, A., Vera, M., Urzay, J.
2021; 33 (8)
- **The turbulent bubble break-up cascade. Part 2. Numerical simulations of breaking waves** *JOURNAL OF FLUID MECHANICS*
Chan, W., Johnson, P. L., Moin, P., Urzay, J.
2021; 912
- **Direct numerical simulation of a hypersonic transitional boundary layer at suborbital enthalpies** *JOURNAL OF FLUID MECHANICS*
Di Renzo, M., Urzay, J.
2021; 912
- **Direct numerical simulation of a hypersonic transitional boundary layer at suborbital enthalpies** *Journal of Fluid Mechanics*
Di Renzo, M., Urzay, J.
2021; 912
- **Shock-induced heating and transition to turbulence in a hypersonic boundary layer** *Journal of Fluid Mechanics*
Fu, L., Karp, M., Bose, S., Moin, P., Urzay, J.
2021; 909: A8
- **HTR solver: An open-source exascale-oriented task-based multi-GPU high-order code for hypersonic aerothermodynamics** *Computer Physics Communications*
Renzo, M., Fu, L., Urzay, J.
2020; 255: 107262
- **Mitigation of turbophoresis in particle-laden turbulent channel flows by using incident electric fields** *PHYSICAL REVIEW FLUIDS*

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- Di Renzo, M., Johnson, P. L., Bassenne, M., Villafane, L., Urzay, J.
2019; 4 (12)
- **Birth of microbubbles in turbulent breaking waves**
Chan, W., Mirjalili, S., Jain, S. S., Urzay, J., Mani, A., Moin, P.
AMER PHYSICAL SOC.2019
 - **A dynamic spectrally enriched subgrid-scale model for preferential concentration in particle-laden turbulence** *INTERNATIONAL JOURNAL OF MULTIPHASE FLOW*
Bassenne, M., Esmaily, M., Livescu, D., Moin, P., Urzay, J.
2019; 116: 270–80
 - **The breakdown of self-similarity in electrified counterflow diffusion flames** *COMBUSTION AND FLAME*
Di Renzo, M., Pascazio, G., Urzay, J.
2019; 205: 231–40
 - **Wavelet multiresolution analysis of particle-laden turbulence** *PHYSICAL REVIEW FLUIDS*
Bassenne, M., Moin, P., Urzay, J.
2018; 3 (8)
 - **The effects of incident electric fields on counterflow diffusion flames** *COMBUSTION AND FLAME*
Di Renzo, M., Urzay, J., De Palma, P., de Tullio, M. D., Pascazio, G.
2018; 193: 177–91
 - **Spatially localized multi-scale energy transfer in turbulent premixed combustion** *JOURNAL OF FLUID MECHANICS*
Kim, J., Bassenne, M., Towery, C. Z., Hamlington, P. E., Polunenko, A. Y., Urzay, J.
2018; 848: 78–116
 - **Aerodynamic Heating in Wall-Modeled Large-Eddy Simulation of High-Speed Flows** *AIAA JOURNAL*
Yang, X. A., Urzay, J., Bose, S., Moin, P.
2018; 56 (2): 731–42
 - **Multi-scale statistics of turbulence motorized by active matter** *JOURNAL OF FLUID MECHANICS*
Urzay, J., Doostmohammadi, A., Yeomans, J. M.
2017; 822: 762–73
 - **Extraction of coherent clusters and grid adaptation in particle-laden turbulence using wavelet filters** *PHYSICAL REVIEW FLUIDS*
Bassenne, M., Urzay, J., Schneider, K., Moin, P.
2017; 2 (5)
 - **A simple dynamic subgrid-scale model for LES of particle-laden turbulence** *PHYSICAL REVIEW FLUIDS*
Park, G., Bassenne, M., Urzay, J., Moin, P.
2017; 2 (4)
 - **The cross-scale physical-space transfer of kinetic energy in turbulent premixed flames** *PROCEEDINGS OF THE COMBUSTION INSTITUTE*
O'Brien, J., Towery, C. A., Hamlington, P. E., Ihme, M., Poludnenko, A. Y., Urzay, J.
2017; 36 (2): 1967-1975
 - **Spectral kinetic energy transfer in turbulent premixed reacting flows** *PHYSICAL REVIEW E*
Towery, C. A., Poludnenko, A. Y., Urzay, J., O'Brien, J., Ihme, M., Hamlington, P. E.
2016; 93 (5)
 - **Constant-energetics physical-space forcing methods for improved convergence to homogeneous-isotropic turbulence with application to particle-laden flows** *PHYSICS OF FLUIDS*
Bassenne, M., Urzay, J., Park, G. I., Moin, P.
2016; 28 (3)
 - **Weak-Shock Interactions with Transonic Laminar Mixing Layers of Fuels for High-Speed Propulsion** *AIAA JOURNAL*
Huete, C., Urzay, J., Sanchez, A. L., Williams, F. A.
2016; 54 (3): 962–75

- **Diffusion-flame ignition by shock-wave impingement on a supersonic mixing layer** *JOURNAL OF FLUID MECHANICS*
Huete, C., Sanchez, A. L., Williams, F. A., Urzay, J.
2015; 784: 74–108
- **Computational hydrodynamics and optical performance of inductively-coupled plasma adaptive lenses** *PHYSICS OF PLASMAS*
Mortazavi, M., Urzay, J., Mani, A.
2015; 22 (6)
- **The role of separation of scales in the description of spray combustion** *PROCEEDINGS OF THE COMBUSTION INSTITUTE*
Sanchez, A. L., Urzay, J., Linan, A.
2015; 35: 1549–77
- **REGIMES OF SPRAY VAPORIZATION AND COMBUSTION IN COUNTERFLOW CONFIGURATIONS** *COMBUSTION SCIENCE AND TECHNOLOGY*
Linan, A., Martinez-Ruiz, D., Sanchez, A. L., Urzay, J.
2014; 187 (1-2): 103–31
- **Turbulence-induced resonance vibrations cause pollen release in wind-pollinated *Plantago lanceolata* L. (Plantaginaceae)** *JOURNAL OF THE ROYAL SOCIETY INTERFACE*
Timerman, D., Greene, D. F., Urzay, J., Ackerman, J. D.
2014; 11 (101)
- **A spinning puzzle of the release of a giant multinucleate multiflagellate zoospore.**
Urzay, J., Ott, D., Prakash, M.
AMER SOC CELL BIOLOGY.2014
- **Subgrid-scale backscatter in reacting and inert supersonic hydrogen-air turbulent mixing layers** *JOURNAL OF FLUID MECHANICS*
O'Brien, J., Urzay, J., Ihme, M., Moin, P., Saghafian, A.
2014; 743: 554–584
- **Uncertainty-quantification analysis of the effects of residual impurities on hydrogen-oxygen ignition in shock tubes** *COMBUSTION AND FLAME*
Urzay, J., Kseib, N., Davidson, D. F., Iaccarino, G., Hanson, R. K.
2014; 161 (1): 1–15
- **Dynamics of thermal ignition of spray flames in mixing layers** *JOURNAL OF FLUID MECHANICS*
Martinez-Ruiz, D., Urzay, J., Sanches, A. L., Linan, A., Williams, F. A.
2013; 734: 387–423
- **Theory of the propagation dynamics of spiral edges of diffusion flames in von Karman swirling flows** *COMBUSTION AND FLAME*
Urzay, J., Nayagam, V., Williams, F. A.
2011; 158 (2): 255–72
- **Asymptotic theory of the elasto-hydrodynamic adhesion and gliding motion of a solid particle over soft and sticky substrates at low Reynolds numbers** *JOURNAL OF FLUID MECHANICS*
Urzay, J.
2010; 653: 391–429
- **Wind gusts and plant aeroelasticity effects on the aerodynamics of pollen shedding: A hypothetical turbulence-initiated wind-pollination mechanism** *JOURNAL OF THEORETICAL BIOLOGY*
Urzay, J., Smith, S., Thompson, E., Glover, B. J.
2009; 259 (4): 785–92
- **Diffusion-flame extinction on a rotating porous-disk burner** *PROCEEDINGS OF THE COMBUSTION INSTITUTE*
Urzay, J., Nayagam, V., Williams, F. A.
2009; 32: 1219–26
- **The elasto-hydrodynamic force on a sphere near a soft wall** *PHYSICS OF FLUIDS*
Urzay, J., Smith, S., Glover, B. J.
2007; 19 (10)