Stanford

Juan Alonso

Vance D. and Arlene C. Coffman Professor and the James and Anna Marie Spilker Chair of the Department of Aeronautics and Astronautics

CONTACT INFORMATION

- **Administrator**

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Bio

BIO

Prof. Alonso is the founder and director of the Aerospace Design Laboratory (ADL) where he specializes in the development of high-fidelity computational design methodologies to enable the creation of realizable and efficient aerospace systems. Prof. Alonso's research involves a large number of different manned and unmanned applications including transonic, supersonic, and hypersonic aircraft, helicopters, turbomachinery, and launch and re-entry vehicles. He is the author of over 200 technical publications on the topics of computational aircraft and spacecraft design, multi-disciplinary optimization, fundamental numerical methods, and high-performance parallel computing. Prof. Alonso is keenly interested in the development of an advanced curriculum for the training of future engineers and scientists and has participated actively in course-development activities in both the Aeronautics & Astronautics Department (particularly in the development of coursework for aircraft design, sustainable aviation, and UAS design and operation) and for the Institute for Computational and Mathematical Engineering (ICME) at Stanford University. He was a member of the team that currently holds the world speed record for human powered vehicles over water. A student team led by Prof. Alonso also holds the altitude record for an unmanned electric vehicle under 5 lbs of mass.

ACADEMIC APPOINTMENTS

- Professor, Aeronautics and Astronautics
- Member, Institute for Computational and Mathematical Engineering (ICME)

ADMINISTRATIVE APPOINTMENTS

- Member, SoE Future Committee, (2015-2016)
- Director, NASA Fundamental Aeronautics Program Office, (2006-2008)

HONORS AND AWARDS

- AHS Forum Best Paper Award, Aircraft Design, American Helicopter Society (2018)
- AIAA SciTech Best Paper Award, Thermophysics Technical Committee, AIAA (2014)
- NASA Aeronautics Associate Administrator Award for High-Fidelity Tool Validation for Sonic Boom, NASA (2014)
- AIAA Associate Fellow, AIAA (2012)
- FAI Altitude World Record, Class U, Unmanned Aerial Vehicles, Electric category, FAI (2010)

- NASA Exceptional Public Service Medal, NASA (2009)

- AIAA Best Paper Award, Multi-Disciplinary Optimization Conferences, AIAA (2004, 2006, 2008)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, NASA Advisory Council (2005 - 2006)

- Member, Sec. of Transp. Future of Aviation Advisory Council (2010 - 2011)

- Member, FAA Management Advisory Council (2011 - 2014)

- Member, FAA Drone Advisory Council (2016 - 2018)

PROFESSIONAL EDUCATION

- PhD, Princeton University , Mechanical & Aerospace Engineering (1997)

- M.A., Princeton University , Mechanical & Aerospace Engineering (1993)

- B.S., Massachusetts Institute of Technology , Aeronautics & Astronautics (1991)

PATENTS

- Juan J. Alonso, Andre S. Chan, Ferdinand Hendriks. "United States Patent 7,177,116 System, Method, and Apparatus for Breaking Up Large-Scale Eddies and Straightening Air Flow Inside Rotary Disk Storage Devices", Sep 1, 2005

- Juan J. Alonso, Andre S. Chan, Ferdinand Hendriks. "United States Patent 7,946,691 System, Method, and Apparatus for Applying Boundary Layer Manipulation Techniques to the Air Flow Inside Rotary Disk Storage Devices", Sep 1, 2005

LINKS

- http://adl.stanford.edu/people/jjalonso.html: http://adl.stanford.edu/people/jjalonso.html

Teaching

COURSES

2023-24

- Aircraft Design: AA 146A (Win)

- Aircraft Design Laboratory: AA 146B (Spr)

2022-23

- Aircraft Design: AA 146A (Aut)

- Aircraft Design Laboratory: AA 146B (Win)

- Seminar in Fluid Mechanics: ENGR 298 (Spr)

- Sustainable Aviation: AA 260 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Faisal As'ad, Efaine Chang, Emily Jewell, Clayton Little, Loren Newton, Tal Schwartz, David Wu

Doctoral Dissertation Advisor (AC)

Racheal Erhard, Brian Munguía, Jacob Needels, Harsh Patel, Tejal Shanbhag, Yiren Shen

Orals Evaluator

Harsh Patel

Master's Program Advisor

Max Fairon, Brandon Hadfield, Daniel Ledesma, Parker Mayhew, Angelo Sui, Matthew Tan, Dalton Vega, Reader Wang, Andy Wu

Publications

PUBLICATIONS

- **A large-scale validation study of aircraft noise modeling for airport arrivals.** *The Journal of the Acoustical Society of America*
  Rindfleisch, T. C., Alonso, J. J., Jackson, D. C., Munguia, B. C., Bowman, N. W.
  2024; 155 (3): 1928-1949

- **Accelerating the Lattice Boltzmann Method**
  Altoyan, W., Alonso, J. J., IEEE
  IEEE.2023

- **Convex Optimization of Low Observability Hypersonic Vehicles**
  Berkenstock, D., Alonso, J., Lessard, L., IEEE
  IEEE.2023

- **Forecasting the Operational Lifetime of Battery-Powered Electric Aircraft** *JOURNAL OF AIRCRAFT*
  Clarke, M. A., Alonso, J. J.
  2022

- **A universal velocity profile for turbulent wall flows including adverse pressure gradient boundary layers** *JOURNAL OF FLUID MECHANICS*
  Subrahmanyam, M. A., Cantwell, B. J., Alonso, J. J.
  2021; 933

- **Parametric Study of Nonequilibrium Shock Interference Patterns over a Fuselage-and-Wing Conceptual Vehicle** *AIAA JOURNAL*
  Garbacz, C., Morgado, F., Fossati, M., Maier, W. T., Munguia, B. C., Alonso, J. J., Loseille, A.
  2021; 59 (12): 4905-4916

- **Comparing Multi-Element Airfoil Flow Solutions Using Multiple Solvers with Output-Based Adapted Meshes** *AIAA JOURNAL*
  Galbraith, M. C., Ursachi, C., Chandel, D., Allmaras, S. R., Darmofal, D. L., Glasby, R. S., Stefanski, D. L., Erwin, J., Holst, K. R., Hereth, E. A., Mukhopadhaya, J., Alonso, J. J.
  2021

- **Lithium-Ion Battery Modeling for Aerospace Applications** *JOURNAL OF AIRCRAFT*
  Clarke, M., Alonso, J. J.
  2021; 58 (6): 1323-1335

- **SU2-NEMO: An Open-Source Framework for High-Mach Nonequilibrium Multi-Species Flows** *AEROSPACE*
  Maier, W. T., Needels, J. T., Garbacz, C., Morgado, F., Alonso, J. J., Fossati, M.
  2021; 8 (7)

- **Shock interactions in inviscid air and CO2-N-2 flows in thermochemical non-equilibrium** *SHOCK WAVES*
  Garbacz, C., Maier, W. T., Scoggins, J. B., Economon, T. D., Magin, T., Alonso, J. J., Fossati, M.
  2021; 31 (3): 239-253

- **Design exploration and optimization under uncertainty** *PHYSICS OF FLUIDS*
  Mishra, A., Mukhopadhaya, J., Alonso, J., Iaccarino, G.
  2020; 32 (8)

- **Investigating Performance Losses in High-Level Synthesis for Stencil Computations**
  Altoyan, W., Alonso, J. J., IEEE Comp Soc
  IEEE COMPUTER SOC.2020: 195–203

- **Application of DDES to Iced Airfoil in Stanford University Unstructured (SU2)**
  Molina, E. S., Silva, D. M., Broeren, A. P., Righi, M., Alonso, J. J., Hoarau, Y., Peng, S. H., Schwamborn, D., Revell, A., Mockett, C.
  SPRINGER INTERNATIONAL PUBLISHING AG.2020: 283–93

- **MULTI-FIDELITY MODELING OF PROBABILISTIC AERODYNAMIC DATABASES FOR USE IN AEROSPACE ENGINEERING** *INTERNATIONAL JOURNAL FOR UNCERTAINTY QUANTIFICATION*
  Mukhopadhaya, J., Whitehead, B. T., Quindlen, J. F., Alonso, J. J., Cary, A. W.

2020; 10 (5): 425–47

- **A Simple and Robust Shock-Capturing Approach for Discontinuous Galerkin Discretizations** *ENERGIES*
  Choi, J., Alonso, J. J., van der Weide, E.
  2019; 12 (14)

- **Polynomial chaos to efficiently compute the annual energy production in wind farm layout optimization** *WIND ENERGY SCIENCE*
  Padron, A., Thomas, J., Stanley, A. J., Alonso, J. J., Ning, A.
  2019; 4 (2): 211–31

- **Uncertainty Estimation Module for Turbulence Model Predictions in SU2** *AIAA JOURNAL*
  Mishra, A., Mukhopadhaya, J., Iaccarino, G., Alonso, J.
  2019; 57 (3): 1066–77

- **CUPyDO - An integrated Python environment for coupled fluid-structure simulations** *ADVANCES IN ENGINEERING SOFTWARE*
  Thomas, D., Cerquaglia, M. L., Boman, R., Economon, T. D., Alonso, J. J., Dimitriadis, G., Terrapon, V. E.
  2019; 128: 69–85

- **Current Capabilities and Challenges of NDARC and SUAVE for eVTOL Aircraft Design and Analysis** *Matthew Clarke*
  Vegh, J. M., Botero, E., Clarke, M., Smart, J., Alonso, J. J.
  American Institute for Aeronautics & Astronautics .2019

- **Strategies for Posing a Well-Defined Problem for Urban Air Mobility Vehicles** *AIAA Scitech 2019 Forum*
  Clarke, M., Smart, J., Botero, E., Maier, W., Alonso, J. J.
  AIAA.2019

- **Sequential Reliability-Based Design Optimization via Anchored Decomposition** *AIAA Scitech 2019 Forum*
  Fenrich, R. W., Alonso, J. J.
  AIAA.2019

- **Flow and noise predictions around tandem cylinders using DDES approach with SU2** *AIAA Scitech 2019 Forum*
  Molina, E. S., Alonso, J. J., Zhou, B. Y., Righi, M., da Silva, R. G.
  AIAA.2019

- **Shock-Induced Separation Suppression Using CFD-Based Active Flow Control Optimization** *AIAA Scitech 2019 Forum*
  Munguia, B. C., Mukhopadhaya, J., Alonso, J. J.
  AIAA.2019

- **Simple shock detector for discontinuous Galerkin method** *AIAA Scitech 2019 Forum*
  Choi, J. H., Alonso, J. J., van der Weide, E.
  AIAA.2019

- **Transonic flow analysis with discontinuous Galerkin method in SU2 DG-FEM solver** *AIAA Aviation 2019 Forum*
  Choi, J. H., Alonso, J. J., van der Weide, E.
  AIAA.2019

- **Primary Weight Estimation for eVTOLs via Explicit Analysis and Surrogate Regression** *AIAA Aviation 2019 Forum*
  Smart, J. T., Alonso, J. J.
  AIAA.2019

- **Connecting Flow over Complex Terrain to Hydrodynamic Roughness on a Coral Reef** *JOURNAL OF PHYSICAL OCEANOGRAPHY*
  Rogers, J. S., Maticka, S. A., Chirayath, V., Woodson, C., Alonso, J. J., Monismith, S. G.
  2018; 48 (7): 1567–87

- **STAGGERED STRONG COUPLING BETWEEN EXISTING FLUID AND SOLID SOLVERS THROUGH A PYTHON INTERFACE FOR FLUID-STRUCTURE INTERACTION PROBLEMS**
  Thomas, D., Variyar, A., Boman, R., Economon, T. D., Alonso, J. J., Dimitriadis, G., Terrapon, V. E., Papadrakakis, M., Onate, E., Schrefler, B.
  INT CENTER NUMERICAL METHODS ENGINEERING.2017: 645–60

- **Performance optimizations for scalable implicit RANS calculations with SU2** *COMPUTERS & FLUIDS*
  Economon, T. D., Mudigere, D., Bansal, G., Heinecke, A., Palacios, F., Park, J., Smelyanskiy, M., Alonso, J. J., Dubey, P.

2016; 129: 146-158

- **SU2: An Open-Source Suite for Multiphysics Simulation and Design** *AIAA JOURNAL*
  Economon, T. D., Palacios, F., Copeland, S. R., Lukaczyk, T. W., Alonso, J. J.
  2016; 54 (3): 828-846

- **Unsteady Continuous Adjoint Approach for Aerodynamic Design on Dynamic Meshes** *AIAA JOURNAL*
  Economon, T. D., Palacios, F., Alonso, J. J.
  2015; 53 (9): 2437-2453

- **Enabling the environmentally clean air transportation of the future: a vision of computational fluid dynamics in 2030** *PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A-MATHEMATICAL PHYSICAL AND ENGINEERING SCIENCES*
  Slotnick, J. P., Khodadoust, A., Alonso, J. J., Darmofal, D. L., Gropp, W. D., Lurie, E. A., Mavriplis, D. J., Venkatakrishnan, V.
  2014; 372 (2022)

- **Enabling the environmentally clean air transportation of the future: a vision of computational fluid dynamics in 2030.** *Philosophical transactions. Series A, Mathematical, physical, and engineering sciences*
  Slotnick, J. P., Khodadoust, A., Alonso, J. J., Darmofal, D. L., Gropp, W. D., Lurie, E. A., Mavriplis, D. J., Venkatakrishnan, V.
  2014; 372 (2022)

- **PDE-constrained optimization with error estimation and control** *JOURNAL OF COMPUTATIONAL PHYSICS*
  Hicken, J. E., Alonso, J. J.
  2014; 263: 136-150

- **Helicopter Rotor Design Using a Time-Spectral and Adjoint-Based Method** *JOURNAL OF AIRCRAFT*
  Choi, S., Lee, K., Potsdam, M. M., Alonso, J. J.
  2014; 51 (2): 412-423

- **Using Supervised Learning to Improve Monte Carlo Integral Estimation** *AIAA JOURNAL*
  Tracey, B., Wolpert, D., Alonso, J. J.
  2013; 51 (8): 2015-2023

- **Robust Grid Adaptation for Efficient Uncertainty Quantification** *AIAA JOURNAL*
  Palacios, F., Duraisamy, K., Alonso, J. J., Zuazua, E.
  2012; 50 (7): 1538-1546

- **Risk Assessment of Scramjet Unstart Using Adjoint-Based Sampling Methods** *AIAA JOURNAL*
  Wang, Q., Duraisamy, K., Alonso, J. J., Iaccarino, G.
  2012; 50 (3): 581-592

- **Multidisciplinary Optimization with Applications to Sonic-Boom Minimization** *ANNUAL REVIEW OF FLUID MECHANICS, VOL 44*
  Alonso, J. J., Colonno, M. R.
  2012; 44: 505-526

- **Prediction of Helicopter Rotor Loads Using Time-Spectral Computational Fluid Dynamics and an Exact Fluid-Structure Interface** *JOURNAL OF THE AMERICAN HELICOPTER SOCIETY*
  Choi, S., Datta, A., Alonso, J. J.
  2011; 56 (4)

- **Design of Adjoint-Based Laws for Wing Flutter Control** *JOURNAL OF AIRCRAFT*
  Palaniappan, K., Sahu, P., Jameson, A., Alonso, J. J.
  2011; 48 (1): 331-335

- **Toward optimally seeded airflow on hypersonic vehicles using control theory** *COMPUTERS & FLUIDS*
  Marta, A. C., Alonso, J. J.
  2010; 39 (9): 1562-1574

- **Numerical and Mesh Resolution Requirements for Accurate Sonic Boom Prediction** *AIAA 42nd Aerospace Sciences Meeting and Exhibit*
  Choi, S., Alonso, J. J., van der Weide, E.
  AMER INST AERONAUT ASTRONAUT. 2009: 1126–39

- **Two-Level Multifidelity Design Optimization Studies for Supersonic Jets** *AIAA 43rd Aerospace Sciences Meeting and Exhibit*
  Choi, S., Alonso, J. J., Kroo, I. M.
  AMER INST AERONAUT ASTRONAUT.2009: 776–90

- **Aircraft design optimization** *6th Pan-American Workshop on Applied and Computational Mathematics*
  Alonso, J. J., LeGrestey, P., Pereyra, V.
  ELSEVIER SCIENCE BV.2009: 1948–58

- **ADJoint: An approach for the rapid development of discrete adjoint solvers** *AIAA/ISSMO 11th Multidisciplinary Analysis and Optimization Conference*
  Mader, C. A., Martins, J. R., Alonso, J. J., van der Weide, E.
  AMER INST AERONAUT ASTRONAUT.2008: 863–73

- **Multifidelity design optimization of low-boom supersonic sets** *AIAA/ISSMO 10th Multidisciplinary Analysis and Optimization Conference*
  Choi, S., Alonso, J. J., Kroo, I. M., Wintzer, M.
  AMER INST AERONAUT ASTRONAUT.2008: 106–18

- **A methodology for the development of discrete adjoint solvers using automatic differentiation tools** *INTERNATIONAL JOURNAL OF COMPUTATIONAL FLUID DYNAMICS*
  Marta, A. C., Mader, C. A., Martins, J. R., van der Weide, E., Alonso, J. J.
  2007; 21 (9-10): 307-327

- **Integrated computations of an entire jet engine** *52nd ASME Turbo Expo 2007*
  Medic, G., You, D., Kalitzin, G., Herrmann, M., Ham, F., Pitsch, H., van der Weide, E., Alonso, J.
  AMER SOC MECHANICAL ENGINEERS.2007: 1841–1847

- **Demonstration of nonlinear frequency domain methods** *AIAA JOURNAL*
  McMullen, M., Jameson, A., Alonso, J.
  2006; 44 (7): 1428-1435

- **An adjoint method for the calculation of remote sensitivities in supersonic flow** *INTERNATIONAL JOURNAL OF COMPUTATIONAL FLUID DYNAMICS*
  Nadarajah, S. K., Jameson, A., Alonso, J.
  2006; 20 (2): 61-74

- **Unsteady CFD simulation of an entire gas turbine high-spool** *51st ASME Turbo Expo 2006*
  Schuelter, J., Apte, S., Kalitzin, G., Pitsch, H., van der Weide, E., Alonso, J.
  AMER SOC MECHANICAL ENGINEERS.2006: 1931–1939

- **A framework for coupling Reynolds-averaged with large-eddy simulations for gas turbine applications** *JOURNAL OF FLUIDS ENGINEERING-TRANSACTIONS OF THE ASME*
  Schluter, J. U., Wu, X., Kim, S., Shankaran, S., Alonso, J. J., Pitsch, H.
  2005; 127 (4): 806-815

- **A coupled-adjoint sensitivity analysis method for high-fidelity aero-structural design** *OPTIMIZATION AND ENGINEERING*
  Martins, J. R., Alonso, J. J., Reuther, J. J.
  2005; 6 (1): 33-62

- **Integrated simulations of a compressor/combustor assembly of a gas turbine engine** *50th ASME Turbo-Expo 2005*
  Schluter, J., Wu, X., Pitsch, H., Kim, S., Alonso, J.
  AMER SOC MECHANICAL ENGINEERS.2005: 971–982

- **Prediction of high-pressure turbine main-/secondary-air system flow interaction** *JOURNAL OF PROPULSION AND POWER*
  Davis, R. L., Alonso, J. J., Yao, J. X., Paolillo, R., SHARMA, O. P.
  2005; 21 (1): 158-166

- **Multi-element high-lift configuration design optimization using viscous continuous adjoint method** *JOURNAL OF AIRCRAFT*
  Kim, S., Alonso, J. J., Jameson, A.
  2004; 41 (5): 1082-1097

- **High-fidelity aerostructural design optimization of a supersonic business jet** *AIAA/ASME/ASCE/AHS/ASC/SDM 43rd Structures, Structural Dynamics, and Materials Conference*

Martins, J. R., Alonso, J. J., Reuther, J. J.
AMER INST AERONAUT ASTRONAUT.2004: 523–30

- **The complex-step derivative approximation** *ACM TRANSACTIONS ON MATHEMATICAL SOFTWARE*
  Martins, J. R., Sturdza, P., Alonso, J. J.
  2003; 29 (3): 245-262

- **Massively parallel simulation of the unsteady flow in an axial turbine stage** *JOURNAL OF PROPULSION AND POWER*
  Yao, J. X., Davis, R. L., Alonso, J. J., Jameson, A.
  2002; 18 (2): 465-471

- **Development and validation of a massively parallel flow solver for turbomachinery flows** *JOURNAL OF PROPULSION AND POWER*
  Yao, J. X., Jameson, A., Alonso, J. J., Liu, F.
  2001; 17 (3): 659-668

- **Perspectives on simulation based aerodynamic design** *1st International Conference on Computational Fluid Dynamics (ICCFD)*
  Jameson, A., Martinelli, L., Alonso, J., Vassberg, J., Reuther, J.
  SPRINGER-VERLAG BERLIN.2001: 135–178

- **Simulation based aerodynamic design** *2000 IEEE Aerospace Conference*
  Jameson, A., Martinelli, L., Alonso, J. J., Vassberg, J. C., Reuther, J.
  I E E E.2000: 55–87

- **Aerodynamic shape optimization of supersonic aircraft configurations via an adjoint formulation on distributed memory parallel computers** *COMPUTERS & FLUIDS*
  Reuther, J., Alonso, J. J., Rimlinger, M. J., Jameson, A.
  1999; 28 (4-5): 675-700

- **Constrained multipoint aerodynamic shape optimization using an adjoint formulation and parallel computers, part 2** *JOURNAL OF AIRCRAFT*
  Reuther, J. J., Jameson, A., Alonso, J. J., Rimlinger, M. J., Saunders, D.
  1999; 36 (1): 61-74

- **Constrained multipoint aerodynamic shape optimization using an adjoint formulation and parallel computers, part 1** *JOURNAL OF AIRCRAFT*
  Reuther, J. J., Jameson, A., Alonso, J. J., Rimlinger, M. J., Saunders, D.
  1999; 36 (1): 51-60