

Aaron S. Towne

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EDUCATION & TRAINING

Stanford University – Postdoctoral Fellow

February 2016 - present

Supervisors: Sanjiva K. Lele, Parviz Moin, Gianluca Iaccarino

California Institute of Technology – Ph.D. Mechanical Engineering

Defended December, 2015

Thesis title: Advancements in jet turbulence and noise modeling: accurate one-way solutions and empirical evaluation of the nonlinear forcing of wavepackets

Research advisor: Tim Colonius

Thesis committee: Fazle Hussain, Beverley McKeon, Guillaume Blanquart

California Institute of Technology – M.S. Mechanical Engineering

Received June, 2010

University of Wisconsin-Madison – B.S. Engineering Mechanics

Received May, 2009

Graduated with Highest Distinction

RESEARCH EXPERIENCE

Center for Turbulence Research, Stanford University – Postdoctoral Fellow

February 2016 – present

Supervisors: Sanjiva K. Lele, Parviz Moin, Gianluca Iaccarino

Topics: low-order modeling of turbulent flows, statistical jet noise models, uncertainty quantification

Cascade Technologies, Inc. – Research Consultant

Palo Alto, CA, February 2017 – present (part-time)

Project manager: Guillaume A. Brès, Gianluca Iaccarino

Topics: online data analysis, jet thrust computation and optimization

California Institute of Technology – Graduate Research Assistant

Computational Flow Physics Group, 2009-2015

Advisor: Tim Colonius

Topics: fast solution methods for linear PDEs via spatial marching, jet turbulence and noise analysis and modeling, acoustic resonance in subsonic jets

United Technologies Research Center – Research Collaborator

Aerodynamics & Acoustics group, 2013-2014

Team: Robert Schlinker, Ramons Reba, John Simonich, Daniel Shannon

Topics: supersonic jet noise control

Center for Turbulence Research Summer Program

Stanford University, 2014

Hosts: Sanjiva K. Lele, Guillaume A. Brès

Topics: jet noise intermittency, trapped acoustic waves in the jet core

University of Wisconsin-Madison – Undergraduate Research Assistant

Engineering Physics Department, 2008-2009

Supervisors: Michael Corradini, Mark Anderson

Topics: supercritical flows in advanced heat exchangers

TEACHING EXPERIENCE

Teaching Assistant – Computational Fluid Dynamics

California Institute of Technology, 2012

Instructor: Tim Colonius

Duties: reviewed course materials in office hours, assisted in designing projects, graded all assignments

Teaching Assistant / Grader – Aerodynamics

University of Wisconsin-Madison, 2008

Instructor: Riccardo Bonazza

Duties: evaluated student work and assigned grades on weekly homework assignments and exams

Tutor – Dynamics, Mechanics of Materials, and Mechanical Vibrations

University of Wisconsin-Madison, Undergraduate Learning Center, 2007-2008

Duties: weekly drop-in and one-on-one tutoring

HONORS & AWARDS

- Center for Turbulence Research Postdoctoral Fellowship, 2016
- **Best Student Paper Award**, AIAA/CEAS Aeroacoustics Conference, 2016
- California Institute of Technology Graduate Research Fellowship, 2009-2010
- Graduated with Highest Distinction, University of Wisconsin-Madison, 2009
- University of Wisconsin-Madison Engineering Physics merit based scholarships, 2006-2008
- University of Wisconsin-Madison Dean's List Honoree, every semester Fall 2004 - Spring 2009

ACADEMIC SERVICE & MEMBERSHIPS

- **Session Chair:** AIAA/CEAS Aeroacoustics Conference (Jet Noise I: Supersonic), 2017
- **Referee:** *Journal of Fluid Mechanics*, *Journal of Computational Physics*, *Proceedings of the Royal Society A*, *AIAA Journal*, *SIAM/ASA Journal on Uncertainty Quantification*, *C.R. Mecanique*, *CTR Proceedings*
- **Reviewer:** Center for Turbulence Research summer program applications, 2016
- **Judge:** Stanford MECON poster competition, 2016
- **Founder & President:** *Bridges at Caltech*, a student organization that helps international students thrive at Caltech, 2014-2015
- **Mentor:** for two first year Caltech graduate students as part of the ME *BigSibs* program, 2012-2013
- **Member:** American Institute of Aeronautics and Astronautics, American Physical Society, Acoustical Society of America

PUBLICATIONS

Peer-reviewed journal articles

Towne, A., Schmidt, O. T., Colonius, T. (2017) Spectral proper orthogonal decomposition and its relationship to dynamic mode decomposition and resolvent analysis. (*Submitted, arXiv:1708.04393*).

Jordan, P., Jaunet, V., **Towne, A.**, Cavalieri, A. V. G., Colonius, T., Schmidt, O. T., and Agarwal A. Jet-edge interaction tones. (*Submitted*)

Brès, G. A., Jordan, P., Le Rallic, M., Jaunet, V., Cavalieri, A. V. G., **Towne, A.**, Lele, S. K., Colonius, T., and Schmidt, O. T. Importance of the nozzle-exit boundary-layer state in subsonic turbulent jets. (*Submitted*)

Sinha, A., **Towne, A.**, Colonius, T., Schlinker, R. H., Reba, R., Simonich, J. S., Shannon, D. W. and Teerlinck, K.A. (2017). Active control of noise from hot supersonic jets. *AIAA Journal*. (*Accepted*)

Towne, A., Cavalieri, A. V. G., Jordan, P., Colonius, T., Jaunet, V., Schmidt, O.T., and Brès, G. A. (2017). Acoustic resonance in the potential core of subsonic jets. *Journal of Fluid Mechanics*, Vol. 825, pp. 1113–1152.

Schmidt, O. T., **Towne, A.**, Colonius, T., Cavalieri, A. V. G., Jordan, P. and Brès, G. A. (2017). Wavepackets and trapped acoustic modes in a Mach 0.9 turbulent jet: a global stability analysis. *Journal of Fluid Mechanics*, Vol. 825, pp. 1153–1181.

Towne, A. and Colonius, T. (2015). One-way spatial integration of hyperbolic equations. *Journal of Computational Physics*, Vol. 300.

Kruizenga, A., Anderson, M., Fatima, R., Corradini, M., **Towne, A.**, Ranjan, D. (2011). Heat transfer of supercritical carbon dioxide in printed circuit heat exchanger geometries. *Journal of Thermal Science and Engineering Applications*, Vol. 3.

Refereed conference papers & refereed technical reports (full-length papers)

Towne, A., Brès, G. A. and Lele, S. K. (2017). A statistical jet-noise model based on the resolvent framework. *AIAA Paper 2017-3706*.

Sanjose, M., Jaiswal, P., Arroyo, C.P., Moreau, S., **Towne, A.**, Lele, S. K. and Mann, A. (2017). Direct numerical simulation of laminar boundary layer instability noise. *AIAA Paper 2017-3190*.

Towne, A., Brès, G. A. and Lele, S. K. (2016). Toward a resolvent-based statistical jet-noise model. *Annual Research Briefs*, Center for Turbulence Research, Stanford University.

Rosenberg, K., Saxton-Foxz, T., Lozano-Duran, A., **Towne, A.**, and McKeon, B. J. (2016). Towards low order models of wall turbulence using resolvent analysis. *Proceedings of the Summer Program*, Center for Turbulence Research, Stanford University.

Sanjose, M., Jaiswal, P., Moreau, S., **Towne, A.** and Lele, S. K. (2016). Laminar boundary layer instability noise. *Proceedings of the Summer Program*, Center for Turbulence Research, Stanford University.

Afsar, M. Z., Sescuz, A., Sassanisz, V., **Towne, A.**, Brès, G. A. and Lele S. K. (2016). Prediction of supersonic jet noise using non-parallel flow asymptotics and LES data within Goldstein's acoustic analogy. *Proceedings of the Summer Program*, Center for Turbulence Research, Stanford University.

Towne, A., Cavalieri, A. V. G., Jordan, P., Colonius, T., Jaunet, V., Schmidt, O. T., and Brès, G. A. (2016). Trapped acoustic waves in the potential core of subsonic jets. *AIAA Paper 2016-2809*.

(Best paper award winner)

Schmidt, O. T., **Towne, A.**, Colonius, T., Jordan, P., Jaunet, V., Cavalieri, A. V. G., and Brès, G. A. (2016). Super- and multi-directive acoustic radiation by linear global modes of a turbulent jet. *AIAA Paper 2016-2808*.

Jaunet, V., Jordan, P., Cavalieri, A. V. G., **Towne, A.**, Colonius, T., Schmidt, O. T., and Brès, G. A. (2016). Tonal dynamics and sound in free and installed turbulent jets. *AIAA Paper 2016-3016*.

Brès, G. A., Jaunet, V., Le Rallic, M., Jordan, P., **Towne, A.**, Schmidt, O. T., Colonius, T., Cavalieri, A. V. G. and Lele, S. K. (2016). Large eddy simulation for jet noise: azimuthal decomposition and intermittency of the radiated sound. *AIAA Paper 2016-3050*.

Towne, A., Colonius, T., Jordan, P., Cavalieri, A.V.G., Brès, G. A. (2015). Stochastic and nonlinear forcing of wavepackets in a Mach 0.9 jet. *AIAA Paper 2015-2217*.

Colonius, T., Sinha, A., Rodríguez, D., **Towne, A.**, Liu, J., Brès, G. A., Appelö, D., and Hagstrom, T. (2015). Simulation and modeling of turbulent jet noise, *Direct and Large-Eddy Simulation IX*

Jordan, P., Colonius, T., Brès, G. A., Zhang, M., **Towne, A.**, and Lele, S. K. (2014). Modeling intermittent wavepackets and their radiated sound in a turbulent jet. *Proceedings of the Summer Program*, Center for Turbulence Research, Stanford University.

Towne, A. and Colonius, T. (2014). Continued development of the one-way Euler equations: application to jets. *AIAA Paper 2014-2903*.

Towne, A. and Colonius, T. (2013). Improved parabolization of the Euler equations. *AIAA Paper 2013-2171*.

PRESENTATIONS (lead-author only)

"Spectral proper orthogonal decomposition and its connection with dynamic mode decomposition and resolvent analysis". *Euromech Colloquium 591*. 18-20 September 2017. Bari, Italy.

"Proper orthogonal decomposition and resolvent analysis". *47th AIAA Fluid Dynamics Conference*. 5-9 June 2017. Denver, CO. (**Invited**)

"A statistical jet-noise model based on the resolvent framework." *23rd AIAA/CEAS Aeroacoustics Conference*. 5-9 June 2017. Denver, CO.

"Model reduction in fluid mechanics: a short tutorial". *Center for Turbulence Research TEA Seminar, Stanford University*. 13 January 2017. Stanford, CA.

"Incorporating correlated nonlinear forcing in resolvent-mode-based jet-noise models". *Jet Noise Modelling and Control, Euromech Colloquium 571 / IUTAM Symposium*. 28-30 September 2016. Palaiseau, France.

"Trapped acoustic waves in the potential core of subsonic jets". *22nd AIAA/CEAS Aeroacoustics Conference*. 30 May – 1 June 2016. Lyon, France.

"Forced wavepacket models of turbulent jet noise". *Center for Turbulence Research TEA Seminar, Stanford University*. 1 April 2016. Stanford, CA.

"A convergent alternative to the parabolized stability equations". *6th Symposium on Global Flow Instability and Control*. 28 September - 2 October 2015. Hersonissos, Crete, Greece.

"Empirical resolvent-mode decomposition". *68th Annual Meeting of the American Physical Society Department of Fluid Dynamics*. 22-24 November 2015. Boston, MA.

"Stochastic and nonlinear forcing of wavepackets in a Mach 0.9 jet". *21st AIAA/CEAS Aeroacoustics Conference*. 22-26 June 2015. Dallas, TX.

"Jet noise models using one-way Euler equations". *67th Annual Meeting of the American Physical Society Department of Fluid Dynamics*. 23-25 November 2014. San Francisco, CA.

"Efficient jet noise models using the one-way Euler equations". *168th Meeting of the Acoustical Society of America*. 27-31 October 2014. Indianapolis, IN.

"Continued development of the one-way Euler equations: application to jets". *20th AIAA/CEAS Aeroacoustics Conference*. 16-20 June 2014. Atlanta, GA.

"One-way Euler equations: a novel spatial marching technique for convective instabilities". *66th Annual Meeting of the American Physical Society Department of Fluid Dynamics*. 24-26 November 2013. Pittsburg, PA.

"Improved parabolization of the Euler equations". *19th AIAA/CEAS Aeroacoustics Conference*. 27-29 May 2013. Berlin, Germany.

"One-way Euler equations". *7th Southern California Symposium on Flow Physics*. 13 April 2013. Pasadena, CA.

"Improved parabolization of the compressible Euler equations". *65th Annual Meeting of the American Physical Society Department of Fluid Dynamics*. 18-20 November 2012. San Diego, CA.

"Parabolized stability equations for jet noise prediction and control". *6th Southern California Symposium on Flow Physics*. 14 April 2012. Santa Barbara, CA.

Updated: 10/20/2017