

Sven Schmitz

Assistant Professor

Department of Aerospace Engineering
The Pennsylvania State University, University Park, PA 16802
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EDUCATION

Ph.D., Mechanical and Aeronautical Engineering, 2006, University of California Davis
Overall GPA: 4.00 / 4.00

Diploma Degree (Dipl. Ing.), Aerospace Engineering, 2002, RWTH Aachen, Germany

PROFESSIONAL EXPERIENCE

09/2010-present Assistant Professor
Department of Aerospace Engineering, The Pennsylvania State University

06/2006-08/2010 Post-Doctoral Research
Department of Mechanical and Aeronautical Engineering (MAE), UC Davis

Joint Research Interchange: NASA-Ames Research Center - UC Davis
“Development of a Hybrid CFD Method for Helicopter Hover Flows”

01/2007-12/2009 Consultant for CFD Method Development with General Electric Wind
Department of Mechanical and Aeronautical Engineering, UC Davis

Research Grant: General Electric Wind - UC Davis
“Development of an Engineering Wind Turbine Design Tool Using Hybrid CFD”

09/2002-06/2006 Doctoral Research
Department of Mechanical and Aeronautical Engineering (MAE), UC Davis

Dissertation:
“Coupling of Navier-Stokes Solver with Helicoidal Vortex Model for the
Computational Study of Horizontal Axis Wind Turbines”

Advisor: Prof. Jean-Jacques Chattot (Chair, MAE Department, UC Davis)

09/2001-06/2002 Diploma Thesis
EADS Space, Munich, Germany

Thesis:
“Numerical Simulation of the Flow in Cooling Channels of Rocket Combustion
Chambers using Coupled Simulation VADUCT”

09/2000-07/2001 Education Abroad Program**DAAD Fellowship (German Academic Exchange Service)**

Department of Mechanical and Aeronautical Engineering (MAE), UC Davis

Completed undergraduate and graduate course work towards Diploma degree.

Project Thesis on a student built RC airplane 'Aerobrick':

"Study of Take-off Roll, Propeller Analysis, and Propeller Design for the Aerobrick A'01"

10/1998-06/2000 Undergraduate Research

Biomedical Fluid Laboratory, Institute of Aerodynamics, RWTH Aachen, Germany

Designed parts of a durability tester for mechanical heart valves, conducted experiments, and maintained test stands.

RESEARCH INTERESTS**Basic and Applied Research in Computational & Experimental Fluid Dynamics**

- Development of Hybrid RANS/Vortex methodologies for wind turbines and helicopters.
- Computational Fluid Dynamics (CFD) for wind turbine and helicopter blades.

Rotorcraft Aeromechanics

- Active rotor concepts for helicopter noise & vibration reduction, CFD
- Experimental investigations of helicopter rotor hub flows

Wind Energy

- Actuator Line Modeling of wind turbines in the atmospheric boundary layer
- Design and optimization of wind turbine blades.
- Wind turbine blade icing.

AWARDS and HONORS**Penn State Engineering Alumni Society (PSEAS) Outstanding Teaching Award** PSU, 2014

Awarded to outstanding Engineering educators for excellence in teaching and for contributions to the art of teaching.

Third M.I.T. Conference Young Researcher Fellowship Award M.I.T., Cambridge MA, 2005
For exemplary research in the field of computational mechanics.

Professors for the Future Fellowship Graduate Studies at UC Davis, 2005
Professors for the Future is a year-long competitive fellowship program designed to recognize and develop the leadership skills of outstanding graduate students and postdoctoral scholars who have demonstrated their commitment to professionalism, integrity, and academic service.

Joseph L. Steger Fellowship Award UC Davis, 2004
For outstanding graduate work and achievement in Computational Fluid Dynamics (CFD).

Outstanding Graduate Student Teaching Award Academic Senate at UC Davis, 2004
For contributions made towards the teaching and learning process at UC Davis.

TEACHING

Assistant Professor Aerospace Engineering, Penn State University
Fully responsible for lectures, labs, and exams.

- **Aerodynamics I, AERSP 311.** Fall 2012-2014
Junior course, 101 students (F'12), 105 students (F'13), 103 students (F'14).
- **Introd. To Numeric. Methods in Fluid Dynamics, AERSP 423.** Spring 2012, 2015
Senior-elective course, 21 students (S'12), 30 students (S'15).
- **Wind Energy Engineering and Projects, AERSP 497C.** Spring 2011-2013
Senior-elective course, 11 students (S'11), 14 students (S'12), 17 students (S'13)
- **Wind Turbine Aerodynamics, AERSP 583.** Spring 2011, 2013-2015
Graduate course, 19 students (S'11), 12 students (S'13), 7 students (S'14), 19 students (S'15)
- **Engineering of Wind Power Plants, AERSP 597C.** Fall 2011
Graduate course, 11 students.

Associate-Instructor Mechanical and Aeronautical Engineering, UC Davis
Fully responsible for lectures, labs, and exams.

- **Thermodynamics, ENG 105.** Fall 2006
Upper-division course, 78 students.
- **Fundamentals of Heat Transfer, EME 165.** Summer Session 2005/2006, Spring 2006
Upper-division course, 24 students (SS'05), 53 students (S'06), 14 students (SS'06).
- **Applied Aircraft Aerodynamics, EAE 127.** Fall 2005
Upper-division course, 68 students.

Undergraduate Research Mentor

Mechanical and Aeronautical Engineering, UC Davis

- Developed and mentored undergraduate research projects for four students resulting in theses of more than 80 pages each, 2004-2009.

Teaching Assistant

Mechanical and Aeronautical Engineering, UC Davis

- Fundamentals of Heat Transfer, EME 165. Winter 2003/2004/2006, Spring 2004
- Applied Aircraft Aerodynamics, EAE 127. Fall 2002-2004
- Theoretical and Computational Aerodynamics, EAE 126. Spring 2003

RESEARCH FUNDING**Computational and Experimental Investigation of Interactional Aerodynamics Relevant to Rotor Hub and Empennage Flows**

PI: **Dr. Sven Schmitz (40%)**, Vertical Lift Research Center of Excellence (VLRCOE)
 Agency: Vertical Lift Consortium (VLC)
 Amount: \$540,000
 Dates: 01/01/2015-12/31/2017

A HPC “Cyber Wind Facility” Incorporating Fully-Coupled CFD/CSD for Turbine-Platform-Wake Interactions with the Atmosphere and Ocean

CO-PI: **Dr. Sven Schmitz (25%)**, Aerospace Engineering, The Pennsylvania State University
 Agency: Department of Energy (DE-FOA-0000415)
 Amount: \$1,200,000
 Dates: 10/01/2011-05/30/2015

Fundamental Physics of Rotor Hub Flows towards Reduction of Helicopter Parasite Drag

PI: **Dr. Sven Schmitz (100%)**, Vertical Lift Research Center of Excellence (VLRCOE)
 Agency: US Army (Penn State VLRCOE Task 1.2)
 Amount: \$1,012,897
 Dates: 10/01/2011-09/30/2016

Fundamental Physics of Active Rotor Concepts for Acoustic and Performance Enhancement

PI: **Dr. Sven Schmitz (33%)**, Vertical Lift Research Center of Excellence (VLRCOE)
 Agency: US Army (Penn State VLRCOE Task 5.1)
 Amount: \$1,474,482
 Dates: 10/01/2011-09/30/2016

Development of a New Undergraduate Course in Wind Energy Engineering

CO-PI: **Dr. Sven Schmitz (20%)**, Aerospace Engineering, The Pennsylvania State University
 Agency: Leonhard Center for the Enhancement of Engineering Education, Penn State
 Amount: \$66,000
 Dates: 10/01/2011-08/31/2013

A New CFD Approach for the Computation of General Rotorcraft Flows

PI: **Dr. Sven Schmitz (100%)**, Mechanical and Aeronautical Engineering, UC Davis
 Agency: NASA Ames (AWARD #NNX08AU38A)
 Amount: \$200,000
 Dates: 09/01/2008-08/31/2010

Validation of a New Coupling Methodology for Hybrid CFD Analysis and Design of Helicopter Rotors

CO-PI: **Dr. Sven Schmitz (50%)**, Mechanical and Aeronautical Engineering, UC Davis.
 Agency: NASA Ames (AWARD #NNA0CB79A)
 Amount: \$149,965
 Dates: 09/01/2006-08/31/2008

Wind Aero Design Tool Development

CO-PI: **Dr. Sven Schmitz (50%)**, Mechanical and Aeronautical Engineering, UC Davis.
 Agency: General Electric Wind (AWARD#08003057)
 Amount: \$119,370
 Dates: 05/01/2007-12/31/2009

PUBLICATIONS

* indicates student of Dr. Schmitz

Peer-reviewed Journal Publications

¹⁸ Jha, P. K., Churchfield, M. J., and **S. Schmitz, S.**, 2015, Blade Load Unsteadiness and Turbulence Statistics in an Actuator-Line Computed Turbine-Turbine Interaction Problem, *Under Review*, ASME Journal of Solar Energy Engineering.

¹⁷ Kody, F.*, Corle, E. L.*, Maughmer, M. D., and **S. Schmitz**, 2015, Higher-Harmonic Deployment of Trailing-Edge Flaps for Rotor-Performance Enhancement and Vibration Reduction, *Under Review*, AIAA Journal of Aircraft.

¹⁶ Reich, D.*, Shenoy, R., Smith, M. , and **S. Schmitz**, 2015, A Review of 60 Years of Rotor Hub Wake Physics (1954-2014), *Under Review*, Journal of the American Helicopter Society.

¹⁵ **Schmitz, S.**, and J. G. Coder, 2015, Inviscid Circulatory-Pressure Field Derived from the Navier-Stokes Equations. AIAA Journal 53(1):33-41.

- ¹⁴ **Schmitz, S.**, 2014, Finite-Domain Viscous Correction to the Kutta-Joukowski Theorem in Incompressible Flow. *AIAA Journal* 52(9):2079-2083.
- ¹³ Reich, D.*, Elbing, B., Berezin, C., and **S. Schmitz**, 2014, Water Tunnel Flow Diagnostics of Wake Structures Downstream of a Model Helicopter Rotor Hub. *Journal of the American Helicopter Society* 59 032001 (12 pages).
- ¹² Jha, P.*, Churchfield, M. J., Moriarty, P. J., and **S. Schmitz**, 2014. Guidelines for Actuator Line Modeling of Wind Turbines on Large-Eddy Simulation-type Grids. *ASME Journal of Solar Energy Engineering* 136:031003-11.
- ¹¹ Dowler, J. L.*, and **S. Schmitz**, 2014. A Solution-Based Stall Delay Model for Horizontal-Axis Wind Turbines. *Wind Energy*. Published online in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/we.1791 (21 pages).
- ¹⁰ Mena, I., **Schmitz, S.**, and D. K. McLaughlin, 2014. An Evaluation of a Course that Introduces Undergraduate Students to Authentic Aerospace Engineering Research, *Accepted with Minor Revisions*, *Advances in Engineering Education*.
- ⁹ Kody, F.*, Bramesfeld, G., and **S. Schmitz**, 2013. An Efficient Methodology for Using a Multi-Objective Evolutionary Algorithm for Winglet Design. *Technical Soaring* 37(3):45-56.
- ⁸ Yiqiang, H., Palacios, J., and **S. Schmitz**. 2012. Scaled Ice Accretion Experiments on a Rotating Wind Turbine Blade, *Journal of Wind Engineering and Industrial Aerodynamics* 109:55-67.
- ⁷ **Schmitz, S.**, Bhagwat, M., Moulton, M. A., Caradonna F. X., and J. J. Chattot. 2009. The Prediction and Validation of Hover Performance and Detailed Blade Loads, *Journal of the American Helicopter Society* 54 032004 (12 pages).
- ⁶ **Schmitz, S.** 2009. On the Tip-Vortex Strength of Low-Drag Wings in Lifting-Line Theory, *Computational Fluid Dynamics Journal*, Technical Note 17:356-359.
- ⁵ **Schmitz, S.**, and J. J. Chattot. 2007. Flow Physics and Stokes' Theorem in Wind Turbine Aerodynamics, *Computers and Fluids* 36:1583-1587, also in *Computational Fluid Dynamics 2006*, Springer :801-806.
- ⁴ **Schmitz, S.**, and J. J. Chattot. 2007. Method for Aerodynamic Analysis of Wind Turbines at Peak Power, *AIAA Journal of Propulsion and Power*, Technical Note 23:243-246.
- ³ **Schmitz, S.**, and J. J. Chattot. 2006. Characterization of Three-Dimensional Effects for the Rotating and Parked NREL Phase VI Wind Turbine, *ASME Journal of Solar Energy Engineering* 128:445-454.
- ² **Schmitz, S.**, and J. J. Chattot. 2006. A Coupled Navier-Stokes/Vortex-Panel Solver for the Numerical Analysis of Wind Turbines, *Computers and Fluids* 35:742-745, also in *Computational Fluid Dynamics 2004*, Springer :289-294.
- ¹ **Schmitz, S.**, and J. J. Chattot. 2005. A Parallelized Coupled Navier-Stokes/Vortex-Panel Solver, *ASME Journal of Solar Energy Engineering* 127:475-487.

Peer-reviewed Conference Proceedings

- ⁵ Suzuki, K., **Schmitz, S.**, Ouyang, H., and J. J. Chattot, 2014. Extension of an Unsteady Hybrid Navier-Stokes/Vortex-Panel Solver to Wind Turbine Aerodynamic Simulations at Higher Yaw Angles, *Proceedings of ASME Turbo Expo*, GT2014-25596.
- ⁴ Mena, I., and **S. Schmitz**, 2013, An Exploratory Study of the Research Mentor Experience in a Novel Undergraduate Aerospace Engineering Course, *Proceedings of the 120th ASEE Conference and Exposition*.
- ³ McLaughlin, D., K., **Schmitz, S.**, and I. Mena, 2013, Report on the Learning Experiences of Undergraduate Students in a Novel Aerospace Engineering Course Integrating Teaching and Research, *Proceedings of the 120th ASEE Conference and Exposition*.

² **Schmitz, S.**, and J. J. Chattot. 2006. Characterization of Three-Dimensional Effects for the Rotating and Parked NREL Phase VI Wind Turbine, AIAA-2006-0392.

¹ **Schmitz, S.**, and J. J. Chattot. 2005. Application of a Parallelized Coupled Navier-Stokes/Vortex-Panel Solver to the NREL Phase VI Rotor, AIAA-2005-0593, A Collection of the 2005 ASME Wind Energy Symposium Technical Papers :167-179.

Conference Proceedings, Presentations

³¹ Corle, E. L.*, **Schmitz, S.**, Yang, T., and K. S. Brentner, 2015. Efficient Active Rotor Concepts for In-Plane Noise Reduction, AIAA-2015-0789.

³⁰ Churchfield, M. J., Wang, Z.*, and **S. Schmitz**, 2015. Modeling Wind Turbine Tower and Nacelle Effects within an Actuator Line Model, AIAA-2015-0214.

²⁹ Blasco, P. M.*, Palacios, J., and **S. Schmitz**, 2015. Investigation of Wind Turbine Power Generation During Atmospheric Icing by Multi-Disciplinary Experimentation, AIAA-2015-0496.

²⁸ Jha, P.*, Duque, E. P. N., Bashioum, J. L.*, and **S. Schmitz**, 2014. Turbulent Transport Phenomena in the Wakes of Wind Turbines, Proceedings of the American Helicopter Society 70th Annual National Forum.

²⁷ Reich, D.*, **Schmitz, S.**, Shenoy, R., and M. Smith, 2014. An Assessment of the Long-Age Unsteady Rotor Hub Wake Physics for Empennage Analysis, Proceedings of the American Helicopter Society 70th Annual National Forum.

²⁶ Yang, T., Brentner, K. S., Corle, E. L.*, and **S. Schmitz**, 2014. Understanding In-Plane Noise Control and Loading for Active Noise Control, Proceedings of the American Helicopter Society 70th Annual National Forum.

²⁵ Kody, F.*, Corle, E.*, Maughmer, M. D., and **S. Schmitz**, 2014. Non-Harmonic Deployment of Trailing Edge Flaps for Rotor Performance Enhancement and Vibration Reduction, AHS 5th Decennial Aeromechanics Specialists' Conference.

²⁴ Jha, P.*, Churchfield, M. J., Moriarty, P. J., and **S. Schmitz**, 2014. The Effect of Various Actuator-Line Modeling Approaches on Turbine-Turbine Interactions and Wake-Turbulence Statistics in Atmospheric Boundary-Layer Flow, AIAA-2014-0710.

²³ Motta-Mena, J., Jha, P.*, Campbell, R., **Schmitz, S.**, and J. G. Brasseur, 2014. Coupling of a Fluid-Structure Interaction – Actuator Line Solver for Implementation in a Cyber Wind Facility, AIAA-2014-0717.

²² **Jha, P. ***, and **S. Schmitz**. 2013. An Actuator Curve Embedding Method to Model Wind Turbine Wakes, (abstract) Bulletin of the American Physical Society :58.

²¹ Reich, D.*, Elbing, B., and **S. Schmitz**, 2013, Experimental Investigation of a Helicopter Rotor Hub Wake(abstract) Bulletin of the American Physical Society :58.

²⁰ Jha, P.*, Churchfield, M. J., Moriarty, P. J., and **S. Schmitz**, 2013. On Turbine-Turbine Interactions Subject to Atmospheric Boundary-Layer Inflow - The Effect of Various Actuator-Line Approaches, International Conference on Future Technologies for Wind Energy, Laramie, WY, Oct. 7-9.

¹⁹ Reich, D.*, Elbing, B., Berezin, C., and **S. Schmitz**, 2013, Water Tunnel Flow Diagnostics of Wake Structures Downstream of a Model Helicopter Rotor Hub, Proceedings of the American Helicopter Society 69th Annual National Forum.

- ¹⁸ Kody, F.*, Maughmer, M. D., and **S. Schmitz**, 2013, Non-Harmonic Deployment of Active Devices for Rotor Performance Enhancement, Proceedings of the American Helicopter Society 69th Annual National Forum.
- ¹⁷ **Schmitz, S.**, and P. K. Jha*, 2013, Modeling the Wakes of Wind Turbines and Rotorcraft Using the Actuator-Line Method in an OpenFOAM – LES Solver, Proceedings of the American Helicopter Society 69th Annual National Forum.
- ¹⁶ Kody, F.*, Bramesfeld, G, and **S. Schmitz**, 2013. Winglet Design for Sailplanes Using Multi-Objective Evolutionary Algorithm, AIAA-2013-0781.
- ¹⁵ Dowler, J. L.*, and **S. Schmitz**, 2013. A Solution-Based Stall Delay Model for Horizontal-Axis Wind Turbines, AIAA-2013-0912.
- ¹⁴ Jha, P.*, Churchfield, M. J., Moriarty, P. J., and **S. Schmitz**, 2013. Accuracy of State-of-the-Art Actuator-Line Modeling for Wind Turbine Wakes, AIAA-2013-0608.
- ¹³ Jha, P. *, Churchfield, M., Moriarty, P., and **S. Schmitz**. 2012. Accuracy of Current Actuator-Line Modeling Methods in Predicting Blade Loads and Wakes of Wind Turbines, (abstract) Bulletin of the American Physical Society :57(17):43.
- ¹² Brasseur, J., Vijayakumar, G., Lavelly, A., Nandi, T., Jayaraman, B., Jha, P.*, Dunbar, A., Motta-Mena, J., Haupt, S., Craven, B., Campbell, R., **S. Schmitz**, and E. Paterson. 2012. The Penn State “Cyber Wind Facility”, (abstract) Bulletin of the American Physical Society :57(17):241.
- ¹¹ Jha, P.*, Brillembourg, D.*, and **S. Schmitz**. 2012. Wind Turbines under Atmospheric Icing Conditions – Ice Accretion Modeling, Aerodynamics, and Control Strategies for Mitigating Performance Degradation, AIAA-2012-1287.
- ¹⁰ **Schmitz, S.** 2011. The Kutta-Zhukovsky Lift Theorem revisited: Alteration due to the Viscous Wake, (abstract) Bulletin of the American Physical Society :56(18):128.
- ⁹ Suzuki, K., **Schmitz, S.**, and J. J. Chattot. 2010. Analysis of a Swept Wind Turbine Blade Using a Hybrid Navier-Stokes/Vortex-Panel Model, Computational Fluid Dynamics 2010, Springer :213-218.
- ⁸ **Schmitz, S.**, Bhagwat, M., and F. X. Caradonna. 2010. Physical and Numerical Issues in the Prediction of Free Wake Hover Performance, Proceedings of the American Helicopter Society 66th Annual National Forum.
- ⁷ **Schmitz, S.**, Bhagwat, M., and F. X. Caradonna. 2009. A Generalized Potential Method for Modeling Rotor Wake Flows, AIAA-2009-3856.
- ⁶ Bhagwat, M., Caradonna, F. X., and **S. Schmitz**. 2009. Some Applications and Developments of the Vorticity Embedded Potential Model for Rotor Flow, Rotorcraft Wake Prediction Basic Research Workshop Proceedings :327-336.
- ⁵ Bhagwat, M., Caradonna, F. X., **Schmitz, S.**, and M. A. Moulton. 2008. Similarity Scaling Trends Using a Hybrid CFD-based Hover Performance Tool, Proceedings of the American Helicopter Society 64th Annual National Forum.
- ⁴ **Schmitz, S.**, Chattot, J. J., Bhagwat, M., Moulton, M. A., and F. X. Caradonna. 2008. The Prediction and Validation of Hover Performance and Detailed Blade Loads, American Helicopter Society Aeromechanics Specialist’s Conference.
- ³ **Schmitz, S.**, Bhagwat, M., Moulton, M. A., and F. X. Caradonna. 2008. A Contour Coupling Methodology for Helicopter Hover Performance Analysis, AIAA-2008-0404.

² **Schmitz, S.**, and J. J. Chattot. 2005. Influence of the Vortical Wake behind Wind Turbines using a Coupled Navier-Stokes/Vortex-Panel Methodology, Computational Fluid and Solid Mechanics 2005, Elsevier Ltd. :832-836.

¹ **Schmitz, S.**, and J. J. Chattot. 2005. Wind Turbine Blade Aerodynamics of the NREL Phase VI Rotor near Peak Power, AIAA-2005-4850.

SERVICE ACTIVITY

Professional Societies:

Member, Aerodynamics Technical Committee (AHS International), 2013 – 2015

Invited Review Panels:

National Science Foundation (NSF), June 2014

Department:

Graduate Admissions Committee, 2011 – 2012, 2014 – 2015

Computational Facilities Committee, September 2011 – Present

Wolk Thesis Award Selection Committee, Reviewing approx. 7 undergraduate research theses and nominating candidates for Wolk Thesis Award, February 2012 - Present

College:

Global Engineering Education (GLEE), September 2010 – December 2012

Engineering Faculty Council (EFC), September 2012 – Present

Chair, Engineering Faculty Council (EFC), May 2014 – Present

Engin. Energy & Environm. Institute (E3I) Steering Committee, January 2013 - Present

University:

University Marshall, College of Engineering Graduation Ceremony, May 2014

Judge Annual Graduate Student Exhibition, March 2011/2012/2015

Reviewer for:

AIAA Journal of Aircraft, 2008-2011, 2013

ASME Turbo Expo, 2009/2011

ASME Journal of Solar Energy Engineering, 2006/2012-2015

Computers and Fluids, 2012/2013-2015

Energies, 2012

Journal of Fluid Mechanics, 2012

Journal of Renewable and Sustainable Energy, 2009/2010

Wind Energy, 2010-2014

Member of the **Academic Federation at UC Davis, 2007-2009**

PROFESSIONAL MEMBERSHIPS

Member of:

American Institute of Aeronautics and Astronautics (AIAA), since 2005

American Helicopter Society (AHS), since 2007

American Society for Engineering Education (ASEE), since 2010

American Physical Society (APS), since 2011

CITIZENSHIP STATUS

German citizen, US permanent resident since December 2009.