

# CHRISTINA M. IVLER

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## FORMAL EDUCATION

PhD, Department of Aeronautics and Astronautics, Stanford University, January 2013

Dissertation Title: *Design and Flight Test of a Cable Angle Feedback Control Law to Improve Helicopter External Load Operations at Low Speed. Advisor: Dr. J. David Powell*

M.S., Aeronautical & Mechanical Engineering, University of California at Davis, June 2005

Thesis Title: *Nonlinear Dynamic Inversion of a Ducted Fan UAV, Advisor: Dr. Ross Hess*

B.S., Aeronautical & Mechanical Engineering, University of California at Davis, June 2003

## PROFESSIONAL EXPERIENCE

Assistant Professor, August 2017 – Present

*Mechanical Engineering, Shiley School of Engineering*

*University of Portland, Portland, OR*

Teaches undergraduate courses in mechanical engineering and performs research in system identification and flight control. Key courses taught include numerical methods, mechanical (control) systems, dynamics, and material science laboratory. Additionally, currently working with 4 undergraduate students on system identification research. Current research efforts include system identification and control of an aerial hexacopter drone and a ground rover.

Research Aerospace Engineer, 2005 – July 2017

*U.S. Army Research Development and Engineering Command, Moffett Field, CA*

*Aviation Development Directorate, Vehicle Dynamics and Control Tech Area*

Performs fundamental and applied research in the area of advanced helicopter and fixed wing flight control concepts, handling qualities and system identification. Development of novel feedback control systems and concepts for aircraft such as cable angle feedback, rotor-state feedback, and control allocation methods. Flight test research control systems as appropriate to validate research feedback control concepts and system identification methods. Publication and presentation of research at technical conferences and in peer-reviewed journals. Acted as Principle Investigator on many projects, key examples are:

- Adaptive Vehicle Management Systems: Worked with Boeing to develop novel active cargo hook control system to damp out slung loads, in combination with cable angle feedback
- Development of system identification models from flight test data, control system design and flight testing of multi-rotor aircraft (indoor)

- In-house Laboratory Independent Research proposal and performed basic research on advanced/novel control allocation techniques for high speed rotorcraft, showing large reduction in actuator rate limiting.
- Rotor-state feedback control laws for improving helicopter gust response and handling qualities in turbulence, using laser measurement of the helicopter

Adjunct Lecturer, January 2014 – June 2017

*Santa Clara University, Santa Clara, CA*

*Mechanical Engineering Department*

Teach undergraduate and graduate courses on an as needed part-time basis. Develop class notes, lecture 2xs a week, assign homework, write/grade midterms/finals, and hold office hours. Courses taught were vibrations, control systems, and system identification.

## **PUBLICATIONS**

### Open Literature: Books

1. Tischler, M.B., Berger, T., Ivler, C.M., Mansur, H.M., *Practical Methods for Aircraft and Rotorcraft Flight Control Design Using Multi-Objective Parameter Optimization*, AIAA Education Series, Reston, VA, 2017.

### Open Literature: Peer Reviewed Journal Articles

1. Cicolani, L., Ivler, C.M., Ott, C., Raz, R., Rozen, A., “Rotational Stabilization of Cargo Container Slung Loads,” *Journal of the American Helicopter Society*, Vol. 50, No. 4, Oct. 2015.
2. Ivler, C.M., “A Constrained State-Space Coupling Numerator Solution and Application to UH-60 Helicopter Control Design,” *AIAA Journal of Guidance, Dynamics and Control*, Vol. 38, No. 10, Oct. 2015.
3. Ivler, C.M., Tischler, M.B, Powell, J.D., “Cable Angle Feedback Control Systems to Improve Handling Qualities for Helicopters with External Loads,” *Journal of the American Helicopter Society*, Oct. 2014, vol. 59.
4. Ivler, C.M., Tischler, M.B., “Case Studies of System Identification Modeling for Flight Control Design”, *Journal of the American Helicopter Society*, January 2013, vol. 58.

### Open Literature: Conference Papers

1. Ivler, C.M., Goerzen, C.L, Wagster, J.A., Sanders, F.C., Cheung, K.K., Tischler, M.B., “Control Design for Tracking of Scaled MTE Trajectories on an IRIS+ Quadcopter,” *American Helicopter Society 74<sup>th</sup> Annual Forum Proceedings*, Phoenix, Arizona, May 14-17, 2018.
2. Knapp, M.K., Ivler, C.M., Berrios, M.G., Berger, T., Tischler, M.B., “Kalman Filter Estimation of Rotor-State Flapping: An Optimization-based Approach with UH-60 Flight Test Data,” *American Helicopter Society 73<sup>rd</sup> Annual Forum Proceedings*, Fort Worth, TX, May 9-11, 2017.

3. Ivler, C.M., Mansur, M.H., Morford, Z., Kalinowski, K., Knapp, M.E., "Flight Test of Explicit and Implicit Rotor-State Feedback Control Laws," American Helicopter Society 72<sup>nd</sup> Annual Forum Proceedings, West Palm Beach, Florida May 17-19 2016.
4. Bellandi, E., Ivler, C.M., Bourreza, A., Brewer, R., Enns, R., Hehr, R., "Design Refinements and Flight Test Stabilization of the AVMS Active External Load Stabilization System," American Helicopter Society 72<sup>nd</sup> Annual Forum Proceedings, West Palm Beach, Florida May 17-19 2016.
5. Ivler, C.M., Juhasz, O., "Evaluation of Control Allocation Techniques for a Medium Lift Tilt-Rotor" American Helicopter Society 71<sup>st</sup> Annual Forum Proceedings, Virginia Beach, Virginia, May 5-7 2015.
6. Patterson, B.W., Ivler, C.M., Hayes, P.M., "External Load Stabilization Control Laws for an H-6 Helicopter Testbed," American Helicopter Society 70<sup>th</sup> Annual Forum Proceedings, Quebec, Canada, May 20-22 2014.
7. Ivler, C.M., "Development and Comparison of Explicit and Implicit Rotor-State Feedback Control System for a Fly-by-Wire UH-60," American Helicopter Society Handling Qualities Specialists' Meeting Proceedings, Hunstville, AL, February 19-20, 2014.
8. Blanken, C.L, Tischler, M.B., Lusardi, J.A., Ivler, C.M., "Aeronautical Design Standard – 33 (ADS-33)... Past, Present, and Future," American Helicopter Society Handling Qualities Specialists' Meeting Proceedings, Hunstville, AL, February 19-20, 2014.
9. Juhasz, O., Ivler, C.M., Tischler, M.B., Celi, R., "Control of a Large Flexible Tiltrotor Aircraft in Hover," American Helicopter Society Handling Qualities Specialists' Meeting Proceedings, Hunstville, AL, February 19-20, 2014.
10. Cicolani, L., Ivler, C., Ott, C., Raz, R., Rosen, A., "Rotational Stabilization of Cargo Container Slung Loads", Proceedings of the American Helicopter Society 69<sup>th</sup> Annual Forum, Phoenix, AZ, May 2013.
11. Ivler, C.M, Powell, J.D., Tischler, M.B., Fletcher J.W., Ott, C., "Design and Flight Test of a Cable Angle/Rate Feedback Flight Control System for the RASCAL JUH-60 Helicopter," Proceedings of the American Helicopter Society 68<sup>th</sup> International Forum, Fort Worth, TX, May 2012.  
*Received Best Paper Award in Handling Qualities Session at AHS Forum 2012*
12. Juhasz, O., Celi, R., Ivler, C.M., Tischler, M.B., Berger, T., "Flight Dynamic Simulation Modeling of Large Flexible Tiltrotor Aircraft," Proceedings of the American Helicopter Society 68<sup>th</sup> International Forum, Fort Worth, TX, May 2012.
13. Ivler, C.M., Tischler, M.B, Powell, J.D., "Cable Angle Feedback Control Systems to Improve Handling Qualities for Helicopters with External Loads," Proceedings of the AIAA Guidance, Navigation and Control Conference, August 2011, Portland OR.
14. Fujizawa, B.T., Ivler, C.M., Tischler, M.B., Morales, E., Braddom, S.R., "In-Flight Simulation Control Law Design and Validation for RASCAL," Proceedings of the American Helicopter Society International 66<sup>th</sup> Annual Forum, May 11-13 2010, Phoenix, AZ.
15. Blanken, C.B., Decker W.B., Ivler C.M., et. al. "An investigation of rotorcraft stability-phase margin requirements in hover," Proceedings of the American

Helicopter Society International 65th Annual Forum, May 27-29 2009, Grapevine TX.

16. Tischler, M.B., Ivler, C.M., Mansur, H.M., Cheung, K.K, Berger, T., Berrios, M., “Handling-Qualities Optimization and Trade-offs in Rotorcraft Flight Control Design,” RAeS Rotorcraft Handling Qualities Conference, November 4-6 2008, Liverpool, UK.
17. Ivler, C.M. , Tischler, M.B., “System Identification Modeling for Flight Control Design,” RAeS Rotorcraft Handling Qualities Conference, November 4-6 2008, Liverpool, UK.
18. Theodore, C., Ivler, C., Tischler, M.B., Field, E., Neville, R., Ross, H, “System Identification of a Large Flexible Transport Aircraft”, AIAA Atmospheric Flight Mechanics Conference and Exhibit, August 18th- 21st 2008, Honolulu, Hawaii.
19. Quiding, C., Ivler, C.M., Tischler, M.B., “GenHel S-76C Model Correlation using Flight Test Identified Models,” Proceedings of the American Helicopter Society 64th Annual Forum, April 29th – May 1st 2008, Montreal, Canada.
20. Downs, J., Prentice, R., Dalzell, S., Besachio, A., Ivler, C.M., Tishcler, M.B., Mansur, M.H., “Control System Development and Flight Test Experience with the MQ-8B Fire Scout Vertical Take-Off Unmanned Aerial Vehicle (VTUAV),” Proceedings of the American Helicopter Society 63rd Annual Forum, May 1-3 2007, Virginia Beach, Virginia.
21. Christensen, K.T., Campbell K.G., Griffith, C.D., Ivler, C.M., Tischler, M.B., Harding, J.W., “Flight Control Development for the ARH-70 Armed Reconnaissance Helicopter Program,” Proceedings of the American Helicopter Society 63rd Annual Forum, May 1-3 2007, Virginia Beach, Virginia.
22. Lawler, M.A., Ivler, C.M., Tischler, M.B., Shtessel, Y.B., “System Identification of the Longitudinal/Heave Dynamics for a Tandem-Rotor Helicopter Including Higher-Order Dynamics,” AIAA Atmospheric Flight Mechanics Conference and Exhibit, August 21-24 2006, Keystone, Colorado.
23. Spaulding\*, C.M., Mansur, M.H., Tischler, M.B., Hess, R.A., Franklin, J.A., “Nonlinear Inversion Control for a Ducted Fan UAV”, AIAA Atmospheric Flight Mechanics Conference and Exhibit, August 15-18 2005, San Francisco, California. Received Best Paper Award for the AIAA AFM Conference 2005

\*Spaulding was Ivler’s maiden name

#### Open Literature: Dissertation and Theses

1. Ivler, C.M., *Design and Flight Test of a Cable Angle Feedback Control Law to Improve Helicopter External Load Operations at Low Speed*, PhD Dissertation, Stanford University, December 2012.
2. Spaulding, C.M.,\* *Nonlinear Dynamic Inversion of a Ducted Fan UAV*, M.S. Thesis, University of California at Davis, June 2005.

\*Spaulding was Ivler’s maiden name

#### Open Literature: Solutions Manuals to Textbooks

1. Ivler, C.M., Berrios, M.G., Tischler, M.B., *Solutions Manual for Aircraft and Rotorcraft System Identification: Engineering Methods with Flight Test Examples*, 2<sup>nd</sup> Edition, AIAA 2012.

2. Ivler, C.M., Tischler, M.B., *Solutions Manual for Aircraft and Rotorcraft System Identification: Engineering Methods with Flight Test Examples*, AIAA 2006.

*Received AHS SFBAC Velkoff Award for Outstanding Technical Publication*

## **AWARDS**

1. U.S. Army Research and Development Achievement (RDA) Award, 2013 for external load cable angle feedback control laws research
2. AHS SF Bay Area Chapter Schroer's Award for Outstanding Rotorcraft Research, 2012 for external load cable angle feedback control laws research
3. Best Paper Award in Handling Qualities, 68<sup>th</sup> AHS Forum, 2012 for external load cable angle feedback research
4. Letter of Appreciation for Contributions and Support on Fire Scout from Northrop Grumman VP of engineering, Advanced Programs & Technology Division. 18 May 2011.
5. NASA Group Achievement Award, 2009 - Rotorcraft Stability and Control VMS Simulation Team
6. AHS SF Bay Area Chapter Velkoff Award for Outstanding Technical Publication 2006 – Solutions manual for Aircraft and Rotorcraft System Identification
7. AIAA Atmospheric Flight Mechanics Conference Best Paper Award 2005. For dynamic inversion of ducted fan UAV research