

# Jinwei Shen

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*Research Interests* Rotorcraft aeromechanics, multibody dynamics analysis, noise and vibration control, finite element analysis, smart structures, and scientific programming.

*Education* ◇ **UNIVERSITY OF MARYLAND** COLLEGE PARK, MD  
Ph.D. in Aerospace Engineering December 2003  
Dissertation: *A Comprehensive Aeroelastic Analysis of Trailing-Edge Flap Helicopter Rotors for Primary Control and Vibration Control*  
Advisor: Dr. Inderjit Chopra  
GPA: 3.9/4.0

M.S. in Aerospace Engineering December 1998

◇ **BEIJING UNIVERSITY OF AERONAUTICS AND ASTRONAUTICS** BEIJING, CHINA  
B.S. in Aerospace Engineering July 1992

*Professional Experience* ◇ **RESEARCH SCIENTIST, NATIONAL INSTITUTE OF AEROSPACE** 2004 - PRESENT  
Develop rotorcraft analytical models using multibody analyses.

- Develop an analytical model of the Wing and Rotor Aeroelastic Testing System (WRATS) tiltrotor wind-tunnel model, and use it to perform parametric study of provided design parameters on loads and stability using DYMORE (A Finite Element Based Tool for the Analysis of Nonlinear Flexible Multibody Systems).
- Investigate effects of drive train dynamics on WRATS soft-in-plane rotor whirl flutter stability characteristics.
- Model WRATS stiff-in-plane rotor, and correlating wing/pylon/rotor loads and stability predictions with NASA Langley TDT (Transonic Dynamics Tunnel) test data.
- Develop an analytical model of a state-of-art stiff-in-plane tiltrotor KARI (Korea Aerospace Research Institute) SUAV using DYMORE and CAMRAD II; both airloads and aeroelastic stability are investigated to support the design process. Conduct parametric study of the effect of key design variables on whirl flutter stability characteristics.
- Develop and validate the DYMORE model of the Sikorsky ABC (Advancing Blade Concept) coaxial rotor. Study coaxial tiltrotor whirl flutter stability characteristics.
- Model MTR (Mono Coaxial Rotor) using DYMORE.

◇ **RESEARCH ASSISTANT (PH.D. LEVEL), UNIVERSITY OF MARYLAND** 1999 - 2003  
Developed a comprehensive aeroelastic analysis of a swashplateless helicopter rotor with trailing-edge flaps.

- Completed a comprehensive aeroelastic analysis of bearingless main rotor based on UMARC (University of Maryland Advanced Rotorcraft Code).
- Validated MDART (McDonnell-Douglas Advanced Rotor Technology) bearingless rotor analysis with wind tunnel test data including rotor loads, performance, and aeroelastic stability.

- Completed correlation of a flapped rotor analysis with CAMRAD II (Comprehensive Analysis Model of Rotorcraft Aerodynamics and Dynamics) predictions for a bearingless rotor (MD 900) and a teetering rotor (ASI 496).
- Derived formulation of an analytical model for a swashplateless helicopter rotor with trailing-edge flaps.
- Conducted parametric design study with predicting rotor loads, performance, aeroelastic stability, and actuation requirements for a swashplateless rotor with trailing-edge flaps for simultaneous primary rotor control and vibration control.
- Developed aeroelastic model of extremely torsionally soft rotor blades.
- Incorporated rotor free wake mode (improved version of Bagai-Leishman model) into UMARC.
- ◇ **RESEARCH ASSISTANT (M.S. LEVEL), UNIVERSITY OF MARYLAND 1996 - 1998**  
Developed a comprehensive aeroelastic analysis of a helicopter rotor with trailing-edge flaps for vibration control.
  - Formulated a fully coupled blade/flap/actuator model based on UMARC.
  - Performed aeroelastic stability analysis for a flapped helicopter bearingless main rotor.
  - Conducted parameter study of helicopter rotor with trailing-edge flaps for vibration reduction including smart actuator dynamics.

*Project Experience*

- ◇ **RESEARCH PROJECTS:**
  - Performed numerical simulations for the Boeing-Mesa MD900 full scale trailing-edge flap system 1997-2001
  - Performed numerical simulations for the NASA/Ames Revolutionary Concept (RevCon) swashplateless rotor project (ASI 496) 2002-2003
  - Performed numerical simulations for the MSMA (Magnetic Shape Memory Alloy ) trailing-edge flap project (U.S. Army AMCOM, AMRDEC in Huntsville, AL) 2003
- ◇ **DESIGN PROJECTS:**
  - Conducted MTR load analyses in support of the design process at Baldwin Technology Company, LLC in Port Washington, NY 2005-2006
  - Conducted KARI UAV load and stability analyses in support of the design process at Eagle Aviation Technologies, Inc in Hampton, VA 2004-2005
  - Was member of the University of Maryland design team who took first-place winning entry in the AHS/Boeing student design competition: "The Chesapeake: an advanced technology 19-seat civil short haul VTOL aircraft." 1999

*Computer Skills*

- ◇ Extensive experience with C, FORTRAN, HTML, Lisp, Pascal, python, perl, bash, TeX/LaTeX.
- ◇ Proficient in Unix/Linux and MS Windows operating environments.

*Memberships*

- ◇ Member AHS since 1998

*Publications*

- ◇ **PEER-REVIEWED JOURNALS**
  - [1] Shen, J., Yang, M., and Chopra, I., "Swashplateless Helicopter Rotor System with Trailing-Edge Flaps for Flight and Vibration Controls," *Journal of Aircraft*, Vol. 43, (2), April-May 2006, pp. 346–352.
  - [2] Shen, J. and Chopra, I., "Aeroelastic Modeling of Trailing-Edge-Flap Helicopter Rotors Including Actuator Dynamics," *Journal of Aircraft*, Vol. 41, (6), November-December 2004, pp. 1465–1472.
  - [3] Shen, J. and Chopra, I., "Swashplateless Helicopter Rotor with Trailing-Edge Flaps," *Journal of Aircraft*, Vol. 41, (2), March-April 2004, pp. 208–214.

- [4] Shen, J. and Chopra, I., "Aeroelastic Stability of Trailing-Edge Flap Helicopter Rotors," *Journal of the American Helicopter Society*, Vol. 48, (4), October 2003, pp. 236–243.
- [5] Shen, J. and Chopra, I., "A Parametric Design Study for a Swashplateless Helicopter Rotor with Trailing-Edge Flaps," *Journal of the American Helicopter Society*, Vol. 49, (1), January 2004, pp. 43–53.
- [6] Masarati, P., Piatak, D., Quaranta, G., Singleton, J., and Shen, J., "Soft-Inplane Tiltrotor Aeromechanics Investigation Using Two Comprehensive Multibody Solvers," *Journal of the American Helicopter Society*, Vol. 53, (2), 2008, pp. 179–192.
- [7] Shen, J., Chopra, I., and Johnson, W., "Swashplateless Ultralight Helicopter Rotor with Trailing-edge Flaps for Primary Flight Control," *Journal of the American Helicopter Society*, accepted for publication.

◇ **CONFERENCE PROCEEDINGS**

- [1] Shen, J., Masarati, P., Roget, B., Piatak, D. J., Nixon, M. W., and Singleton, J. D., "Modeling A Stiff-Inplane Tiltrotor Using Two Multibody Analyses: A Validation Study," Proceedings of AHS 64th Annual Forum, Montreal, Canada, April 29 - May 1 2008, p. 9.
- [2] Shen, J., Masarati, P., Roget, B., Piatak, D. J., Nixon, M. W., and Singleton, J. D., "Stiff-Inplane Tiltrotor Aeromechanics Investigation Using Two Multibody Analyses," ECCOMAS Multibody Dynamics 2007 Proceedings, Milan, Italy, June 25-28 2007, p. 18.
- [3] Shen, J., Singleton, J. D., Piatak, D. J., and Bauchau, O. A., "Multibody Dynamics Simulation and Experimental Investigation of a Model-Scale Tiltrotor," American Helicopter Society 61st Annual Forum Proceedings, Grapevine, TX, June 2005.
- [4] Shen, J., Floros, M., Lee, M. K., and Kim, J. M., "Multibody Dynamics Simulation of a Tiltrotor UAV," Proceedings of the 2nd International Basic Research Conference on Rotorcraft Technology, Nanjing, China, November 2005, pp. 302–309.
- [5] Shen, J. and Chopra, I., "Actuation Requirements of Swashplateless Trailing-Edge Flap Helicopter Rotor in Maneuvering and Autorotation Flights," American Helicopter Society 60th Annual Forum Proceedings, Baltimore, MD, June 8-10 2004, p. 9.
- [6] Shen, J., Chopra, I., and Johnson, W., "Performance of Swashplateless Ultralight Helicopter Rotor with Trailing-edge Flaps for Primary Flight Control," American Helicopter Society 59th Annual Forum Proceedings, Phoenix, AZ, May 6-8 2003, p. 11.
- [7] Shen, J. and Chopra, I., "Ultralight Helicopter with Trailing-Edge Flap for Primary Control," Proceedings of American Helicopter Society International Meeting on Advanced Rotorcraft Technology and Life Saving Activities, Tochigi, Japan, November 2002, p. 10.
- [8] Floros, M., Shen, J., Lee, M. K., and Hwang, S., "Loads and Stability Analysis of an Unmanned Tilt Rotor," American Helicopter Society 62nd Annual Forum Proceedings, Phoenix, AZ, May 2006, p. 19.
- [9] Masarati, P., Quaranta, G., Piatak, D. J., Singleton, J. D., and Shen, J., "Further Results of Soft-Inplane Tiltrotor Aeromechanics Investigation Using Two Multibody Analyses," Proceedings of the 31st European Rotorcraft Forum, Firenze, Italy, September 2005, p. 14.

◇ **CONFERENCE PROCEEDINGS (ALSO APPEARED IN PEER-REVIEWED JOURNAL)**

- [1] Shen, J., Yang, M., and Chopra, I., "Swashplateless Helicopter Rotor System with Trailing-Edge Flaps for Flight and Vibration Controls," Paper No. AIAA-2004-1951, Proceeding of the 45th AIAA/ASME/ASCE/AHS structures, structural dynamics, and materials conference, Palm Springs, CA, April 2004, p. 10.
- [2] Shen, J. and Chopra, I., "A Parametric Design Study for a Swashplateless Helicopter Rotor with Trailing-Edge Flaps," American Helicopter Society 58th Annual Forum Proceedings, Montreal, Canada, June 11-13 2002, p. 15.

- [3] Shen, J. and Chopra, I., "Actuation Requirements for a Swashplateless Helicopter Control System With Trailing-Edge Flaps," Paper No. AIAA-2002-1444, Proceeding of the 43rd AIAA/ASME/ASCE/AHS structures, structural dynamics, and materials conference and 10th AIAA/ASME/AHS adaptive structures conference, Denver, Colorado, April 2002, p. 11.
- [4] Shen, J. and Chopra, I., "Aeroelastic Stability of Smart Trailing-Edge Flap Helicopter Rotors," AIAA-2001-1675, Proceedings of the 42<sup>nd</sup> AIAA/ASME/ASCE/AHS/ASC structure, structural dynamics, and materials conference, Seattle, WA, April 16-19 2001, p. 11.
- [5] Shen, J. and Chopra, I., "Aeroelastic Modeling of Trailing-Edge Flaps with Smart Material Actuators," AIAA-2000-1622, Proceedings of the 41<sup>st</sup> AIAA/ASME/ASCE/AHS/ASC structure, structural dynamics, and materials conference, Atlanta, GA, April 3-6 2000, p. 14.

◇ **REPORTS**

- [1] Bernhard, A., Kiddy, J., Moody, R. C., Shen, J., Sirohi, J., Yang, M., and Yeo, H., "Chesapeake Civil Transport Rotorcraft," Technical report, University of Maryland, College Park, MD, May 1998.

◇ **ORAL PRESENTATIONS**

- [1] Shen, J. and Chopra, I., "A Swashplateless Helicopter Rotor System with Trailing-Edge Flaps for Primary and Vibration Controls," Presented at the 10<sup>th</sup> ARO Workshop on Aeroelasticity of Rotorcraft Systems, Atlanta, GA, November 2003.
- [2] Shen, J. and Chopra, I., "Analysis of a Swashplateless Rotor with Smart Trailing-Edge Edge Flaps," Presented at the 9<sup>th</sup> ARO Workshop on Aeroelasticity of Rotorcraft Systems, Ann Arbor, MI, October 2001.
- [3] Shen, J. and Chopra, I., "Analysis of a Swashplateless Rotor with Smart Trailing-Edge Edge Flaps," Presented at AHS North-East Region National Technical Specialists' Meeting on Active Rotor Technology, Bridgeport, CT, October 2000.
- [4] Shen, J. and Chopra, I., "Aeroelastic Modeling of Trailing-Edge Flap Rotor with Smart Materials Actuation," Presented at the 8<sup>th</sup> ARO Workshop on Aeroelasticity of Rotorcraft Systems, University Park, PA, October 1999.