

# Mandar D. Kulkarni

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## OBJECTIVE

Seeking a full-time research position in an organization with competitive and stimulating environment where I can apply my industrial and research experience in structural analysis, aerodynamic analysis, and multidisciplinary design optimization for solving challenging engineering and science problems.

## EDUCATION

**PhD in Aerospace and Ocean Engineering Department** (Aug. 2011- May 2016 expected)  
Virginia Polytechnic Institute and State University, Blacksburg, USA; GPA: 3.85/4.00

**Bachelor of Technology and Master of Technology in Aerospace Engineering** (Jul. 2004 – Jun. 2009)  
Indian Institute of Technology (IIT) Bombay, Mumbai, India  
*Specialization: Aerospace Structures; GPA: 9.42 / 10.0*

## INDUSTRIAL EXPERIENCE

**Airbus Engineering Centre, Bangalore, India** (Apr. 2010 – May 2011)  
*Associate Engineer in Loads and Aeroelasticity Team*

- Estimated loads on aircraft during various manoeuvres for aircraft design certification.
- Accelerated completion of projects related to flight mechanics, aeroelasticity and structural analysis with shell scripting.

**MSC Software (Symphony Technology Group), Pune, India** (Jul. 2009 – Mar. 2010)  
*Senior Application Engineer in Verification and Validation (V&V) Team*

- Involved in V&V of new developments in the finite element solver NASTRAN® related to statics, frequency response, non-linear analysis, aeroelasticity.

**Department of Statistics, University of Klagenfurt, Klagenfurt, Austria** (May 2007 – Jul. 2007)  
*Intern for the project ‘Spatial prediction using Bayesian Trans-gaussian Kriging’*

- Optimized a MATLAB® program used for spatial prediction of an event using Kriging techniques.

## RESEARCH EXPERIENCE

**Non-intrusive Continuum Sensitivity Analysis for Aeroelastic Shape Optimization (Ph.D. Thesis)**

*Advisor: Dr. Robert A. Canfield, Aerospace and Ocean Engineering, Virginia Tech* (Nov. 2012 – present)

- Investigating methods of implementing **(analytic) Continuum Sensitivity Analysis**.
- Formulating a non-intrusive (or black-box) method of sensitivity analysis for shape optimization, which is **more accurate and less computationally expensive** than the current methods.
- Extending the non-intrusive method for nonlinear aeroelasticity applications.
- Developed an adjoint formulation of CSA to account for large number of design variables.

**Aerodynamic Modeling of Flapping Wing Micro-Air-Vehicles (MAVs)**

*Advisor: Dr. Mayuresh J. Patil, Aerospace and Ocean Engineering, Virginia Tech* (Aug. 2011 – Oct. 2012)

- Developed a **reduced order aerodynamic model** for unsteady aerodynamics of flapping flight based on Unsteady Vortex Lattice Method (UVLM) and Momentum Disc Theory.
- Demonstrated that this model is more accurate than quasi-steady models and could be used for **conceptual MAV design**.

## **Active Vibration Control of Aircraft Structure using Piezo-ceramic Stack Actuators (*Masters Thesis*)**

Advisor: Prof. Prasanna M. Mujumdar, Aerospace Engineering, IIT Bombay (May 2008 – Jun. 2009)

- Experimentally demonstrated **active vibration control** of wing box of a typical fighter aircraft by designing optimal control law and implementing it using state-of-the-art data acquisition system.
- Performed simulations and experiments to establish use of **Piezo-ceramic stacks** for vibration control.
- Acquired expertise in data acquisition, signal processing, and frequency response experimentation techniques.

## **Stress Wave Attenuation during Ballistic Impact on a Ceramic Target**

(Jul. 2006 – Mar. 2008)

Advisor: Prof. Niranjan K. Naik, Aerospace Engineering, IIT Bombay

- Numerically and experimentally demonstrated **attenuation of stress waves** due to ballistic impact on ceramic tiles for possible applications in design of armors and military vehicles.
- Proposed the **novel concept of stress wave attenuation coefficient** for ceramics tiles.

## **Effect of Back Pressure on Impact Characteristics of Composites**

(May 2006 – Aug. 2006)

Advisor: Prof. Niranjan K. Naik, Aerospace Engineering, IIT Bombay

- Designed and fabricated equipment for pressurizing glass-fiber composite specimens.
- Experimentally investigated the effect of **low-velocity-impact** on pressurized composite vessels.

## **PUBLICATIONS**

### **Journals:**

- M. D. Kulkarni, D. M. Cross, and R. A. Canfield, “Discrete Adjoint Formulation using Local Continuum Sensitivity Equations,” *AIAA Journal*, doi: [10.2514/1.J053827](https://doi.org/10.2514/1.J053827) (in press as of **Mar. 2016**).
- M. D. Kulkarni, R. A. Canfield, and M. J. Patil, “Nonintrusive Continuum Sensitivity Analysis for Three Dimensional Structures: Direct and Adjoint Formulations,” *Structures and Multidisciplinary Optimization* (in preparation as of **Mar. 2016**)
- M. D. Kulkarni, R. A. Canfield, and M. J. Patil, “Nonintrusive Continuum Sensitivity Analysis for Fluid Applications,” *Journal of Fluids and Structures* (in preparation as of **Mar. 2016**)
- M. D. Kulkarni, R. A. Canfield, and M. J. Patil, “Nonintrusive Continuum Sensitivity Analysis for Aeroelasticity Applications,” *Structures and Multidisciplinary Optimization* (in preparation as of **Mar. 2016**)
- R. Goel, M. D. Kulkarni, K. S. Pandya, and N. K. Naik, “Stress Wave Micro–Macro Attenuation in Ceramic Plates Made of Tiles during Ballistic Impact,” *International Journal of Mechanical Sciences*, Vol. 83, Issue 2, pp. 30-37, doi: [10.1016/j.ijmecsci.2014.03.020](https://doi.org/10.1016/j.ijmecsci.2014.03.020), **Mar. 2014**.
- M. D. Kulkarni, R. Goel, and N. K. Naik, “Effect of Back Pressure on Impact and Compression-after-Impact Characteristics of Composites,” *Composite Structures*, Vol. 93, Issue 2, pp. 944-951, doi: [10.1016/j.compstruct.2010.06.027](https://doi.org/10.1016/j.compstruct.2010.06.027), **Jan. 2011**.
- N. K. Naik, R. Goel, and M. D. Kulkarni, “Stress Wave Attenuation in Ceramic Plates,” *Journal of Applied Physics*, Vol. 103, Issue 10, Article No. 103504, doi: [10.1063/1.2921971](https://doi.org/10.1063/1.2921971), **May 2008**.

### **Conferences:**

- M. D. Kulkarni, R. A. Canfield, and M. J. Patil, “Non-intrusive Continuum Sensitivity Analysis for Aerodynamic Shape Optimization,” *16<sup>th</sup> Multidisciplinary Analysis and Optimization Conference, AIAA Aviation*, Paper No. AIAA-2015-3237, Dallas, TX, USA, doi: [10.2514/6.2015-3237](https://doi.org/10.2514/6.2015-3237), **Jun. 2015**.
- M. D. Kulkarni, R. A. Canfield, and M. J. Patil, “Discrete Adjoint Formulation using Local Continuum Sensitivity Equations,” *56<sup>th</sup> AIAA Structures, Structural Dynamics and Materials Conference, AIAA SciTech*, Paper No. AIAA-2015-0138, Kissimmee, FL, USA, doi: [10.2514/6.2015-0138](https://doi.org/10.2514/6.2015-0138), **Jan. 2015**.

- M. D. Kulkarni and R. A. Canfield, "Reliability Based Structural Design using Continuum Sensitivity Analysis," *56<sup>th</sup> AIAA Structures, Structural Dynamics and Materials Conference, AIAA SciTech*, Paper No. AIAA-2015-0458, Kissimmee, FL, USA, [doi: 10.2514/6.2015-0458](https://doi.org/10.2514/6.2015-0458), **Jan. 2015**.
- M. D. Kulkarni, R. A. Canfield, and M. J. Patil, "Non-intrusive Continuum Sensitivity Analysis for Aerodynamic Shape Optimization," *15<sup>th</sup> Multidisciplinary Analysis and Optimization Conference, AIAA Aviation*, Paper No. AIAA-2014-2043, Atlanta, GA, USA, [doi: 10.2514/6.2014-2043](https://doi.org/10.2514/6.2014-2043), **Jun. 2014**.
- M. D. Kulkarni, R. A. Canfield, M. J. Patil, E. J. Alyanak, "Integration of Geometric Sensitivity and Spatial Gradient Reconstruction for Aeroelastic Shape Optimization," *10<sup>th</sup> Multidisciplinary Design Optimization Conference, AIAA SciTech*, Paper No. AIAA-2014-0470, National Harbor, MD, USA, [doi: 10.2514/6.2014-0470](https://doi.org/10.2514/6.2014-0470), **Jan. 2014**.
- M. D. Kulkarni, M. J. Patil, R. D. Snyder, "Reduced Order Model for Unsteady Aerodynamics of Flapping Wing Micro Air Vehicle in Hover," *54<sup>th</sup> AIAA Structures, Structural Dynamics and Materials Conference, AIAA SciTech*, Paper No. AIAA-2013-1645, Boston, MA, USA, [doi: 10.2514/6.2013-1645](https://doi.org/10.2514/6.2013-1645), **Apr. 2013**.
- M. D. Kulkarni, G. Kumar, P. M. Mujumdar, and A. Joshi, "Active Control of Vibration Modes of Wing Box by Piezoelectric Stack Actuators," *51<sup>st</sup> AIAA Structures, Structural Dynamics and Materials Conference*, Paper No. AIAA-2010-2949, Orlando, FL, USA, [doi: 10.2514/6.2010-2949](https://doi.org/10.2514/6.2010-2949), **Apr. 2010**.
- M. D. Kulkarni, R. Goel, and N. K. Naik, "Effect of Back Pressure on Impact Behavior of Composites," *4<sup>th</sup> International Conference on Theoretical, Applied, Computational and Experimental Mechanics*, IIT Kharagpur, India, **Dec. 2007**.
- R. Goel, M. D. Kulkarni, and N. K. Naik, "Stress Wave Attenuation during Ballistic Impact on a Ceramic Target," *16<sup>th</sup> International Conference on Composite Materials*, Kyoto, Japan, [available online](#), **Jul. 2007**.

## **AWARDS AND ACHIEVEMENTS**

- Awarded '**Dr. Shankar Dayal Sharma Gold Medal**' for being the most outstanding student in general proficiency, excellence in academic performance, extra-curricular activities and social services among all 1600 degree recipients of IIT Bombay in the year 2009.
- Awarded **Institute Silver Medal** and **Boeing Scholar Award** for standing 1<sup>st</sup> among Dual Degree (B.Tech, M.Tech) students of Aerospace Engineering Department, IIT Bombay in the year 2009.
- Awarded **Pratt Fellowship** based on outstanding performance as a graduate student, for the academic year 2014-2015.
- Won 6<sup>th</sup> place in 2<sup>nd</sup> **International Cold Formed Steel Student Design Competition** in 2012.
- **Finalist in AIAA 2015 Student Competition**: Qualified for the final round of student competition at AIAA Multidisciplinary Analysis and Optimization Conference, Jun. 2015.
- **Best paper presentation**: Won the first prize for the project on 'Composites Structures' in national level students' paper presentation competition at 'Zephyr 2006', Aerospace Engg. Association, IIT Bombay.
- **Winter Academy 2007**: One of the seven students to represent IIT Bombay at the annual Indo-German students meeting at Guwahati, India; Presented a talk on 'Finite Element Analysis of Dynamic Systems'.

## **SKILLS**

- **Technical specialties**: Mathematical modeling, Optimization, Computation methods for structural and fluid analysis, Solid mechanics, Fluid mechanics, Experimental testing of ceramics and composite materials.
- **Software**:  
*Structural Analysis*: NASTRAN, PATRAN, ABAQUS, ANSYS  
*Fluid Analysis*: FLUENT, ZEUS, ZAERO, OpenFOAM, SU2  
*Other*: MATLAB, SIMULINK, LabVIEW, SOLIDWORKS, AUTOCAD, MATHEMATICA
- **Programming Languages**: C, C++, Fortran, Python, MATLAB, Shell scripting

**EXTRA-CURRICULAR ACTIVITIES**: Involved in amateur HAM radio (US Technician License – KK4SXZ), amateur astronomy, paper aero-modeling, hiking and biking.

## **REFERNCES**

### **Dr. Robert A. Canfield**

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