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## SUMMARY

Dr. Khan is the founder and principal engineer at Endeavos Innovations started in 2014. He has a unique multidisciplinary background with MS in the field of structures & composites and holds a Ph.D. in the field of dynamical systems, controls, and mechatronics. He has over 22 years of experience working as a mechanical & mechatronics engineer. He has extensive experience in product development in diverse areas including biomedical and robotic devices, UAVs and wind turbines. He is adept at using minimum viable product development methods combined with his knowledge of lean six sigma methods and tools such as FMEA and DOE. Dr. Khan is a certified lean six sigma green belt (DMAIC & DFSS). He has applied his multi-disciplinary knowledge to solve complex problems and generate novel ideas and solutions. One such example is a novel wind turbine hub concept. This project started with a simple sketch in 2012 that turned in to a multi-million dollar R&D program at GE global research and GE renewable energy business. Dr. Khan is the sole inventor on this patent. In his current capacity as founder and lead consultant at Endeavos Innovations Inc., he is actively involved in supporting R&D efforts at various companies including GE Global research and Schlumberger Doll Research center. These efforts involve finite element modeling and analysis of complex structures, multi-domain system modeling, design and performance optimization and prototyping. In 2018, DBA status was changed to incorporate the company as Endeavos Innovations Inc. At the same time, Dr. Khan has teamed up with experienced former colleagues to serve as associates (partners) of the company.

## Experience & Knowledge Areas

- Finite Element Analysis: Linear and non-linear structural analysis, Transient, Modal, Harmonic, Explicit dynamics, Fatigue and Thermal analysis.
- Multidisciplinary lumped parameter modeling (rigid body, structural dynamics & vibration, Thermo/Fluid, heat transfer & electro-mechanical systems (Implemented in Matlab/Simulink).
- Design Evaluation & Optimization. Topology & Shape Optimization
- Certified lean six sigma green belt (DFSS).
- Familiarity with design for manufacturing and assembly (DFMA) principles.
- Experienced in mechanical design and material selection based on Ashby Charts.
- Robotics & Automation, Linear system theory and controls (PID, state space, optimal) and non-linear control methods. Implementation of Control hardware & DAQ Implementation.

## Patents

1. *Wind turbine rotor and methods of assembling the same*, United States US 20140140851 A1, Issued November 21, 2012.
2. *Aerodynamic hub assembly for a wind turbine*, United States US 9353729 B2, Issued May 31, 2016.
3. *Mechanism for biaxial rotation of a wing and vehicle containing such mechanism*, United States US 7651051 B2, Issued November 7, 2006.
4. *Automated systems and methods for isolating regenerative cells from adipose tissue*, United States US 13/097,827, Issued April 29, 2011.

## Journal Publications

1. Zaeem A. Khan, Sunil K Agrawal, " *Optimal Hovering Kinematics of Flapping Wings for Micro Air Vehicles*", AIAA Journal, Vol 49, No 2, February, 2011
2. Zaeem A. Khan, Sunil K Agrawal, "*Study of biologically inspired flapping mechanism for micro air vehicles* ", AIAA Journal, Vol 49, No 7, July, 2011.
3. Rajkiran Madangopal, Zaeem A. Khan, Sunil K Agrawal, "Energetics Based Design of Small Flapping Wing Air Vehicles", IEEE/ASME TRANSACTIONS ON MECHATRONICS, VOL. 11, NO. 4, 2006.
4. Sean H. McIntosh, Zaeem A. Khan, Sunil K. Agrawal, "Design of a Mechanism for Biaxial Rotation of a Wing for a Hovering Vehicle", IEEE/ASME TRANSACTIONS ON MECHATRONICS, 2006, VOL. 11, 2.
5. Rajkiran Madangopal, Zaeem A. Khan, Sunil K Agrawal, "Biologically Inspired Design Of Small Flapping Wing Air Vehicles Using Four Bar Mechanisms And Quasi Steady Aerodynamics", Journal of Mechanical Design, 2004, Vol. 127.

## Conference Publications

1. Zaeem A. Khan, Sunil K. Agrawal, "Development of a Flapping Mechanism Based on a Model of insect thorax", IEEE International Conference on Robotics and Automation, Kobe, Japan, 2009.
2. Zaeem A. Khan, Sunil K. Agrawal, "Longitudinal Flight Dynamics of a Flapping-Wing Micro Air Vehicle Using Time-Averaged Model and Differential Flatness Based Controller", American Controls Conference, New York City, New York, 2007.
3. Zaeem A. Khan, Sunil K. Agrawal, "Design and Optimization of a Biologically Inspired Flapping Mechanism for Flapping Wing Micro Air Vehicles", IEEE International Conference on Robotics and Automation, Roma, Italy, 2007.
4. Zaeem A. Khan, Sunil K. Agrawal, "Design of Flapping Mechanisms Based on Transverse Bending Phenomena in Insects", IEEE International Conference on Robotics and Automation, Orlando, Florida, 2006.
5. Zaeem A. Khan, Sunil K. Agrawal, "Force And Moment Characterization Of Flapping Wings For Micro Air Vehicle Application", American Controls Conference, Portland, Oregon, 2005.
6. Zaeem A. Khan, Sunil K. Agrawal, "Modeling And Simulation Of Flapping Wing Micro Air Vehicles", ASME International Design Engineering Technical Conferences, Long Beach, California, 2005.
7. Banala, S. K., Agrawal, S. K., Karakaya, Y., McIntosh, S., and Khan, Z., 2004. "Design and optimization of a mechanism for out of plane insect wing like motion with twist", ASME Conference, International Design Engineering and Technical Conferences.
8. Chengkun Zhang, Zaeem A. Khan, Sunil K Agrawal, "Experimental Investigation on Effects of Wing Aspect Ratio and Flexibility on Aerodynamic performance", IEEE conference on Robotics and Automation, Anchorage, Alaska, 2010.

## Miscellaneous Awards & Achievements

Dr. Khan's doctorate research on biologically inspired micro air vehicle has received numerous press mentions including articles in popular press such as News Journal, and his TV interview on "Tech Knowledge" aired by the science channel of discovery networks. Link:

<https://www.youtube.com/watch?v=roYiVJmgopM&t=7s>

He also received the annual biomimicry and engineering award at the IDETC in 2004.