

SANDESH G. BHAT

DrSGBhat.github.io

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Sandesh Bhat is a experienced researcher with a proven track record of driving innovative projects and leading multidisciplinary teams in biomechanics and robotics. Adept at translating complex concepts into practical solutions, contributing to advancements that shape the forefront of human motion analysis and biomechanics.

EDUCATION

Doctor of Philosophy in Systems Engineering

Specialization in Robotics, Dynamics & Biomechanics

Ira A. Fulton Schools of Engineering

Arizona State University, U.S.A.

January 2018 - May 2021

GPA: 4/4

Master of Science in Mechanical Engineering

Specialization in Robotics & Control

Department of Mechanical and Aerospace Engineering

Arizona State University, U.S.A.

August 2016 - December 2017

GPA: 3.44/4

Bachelor of Engineering

Specialization in Mechanical Engineering

Department of Mechanical Engineering

University of Mumbai, India

August 2012 - May 2016

CGPA: 7.71/10

EXPERIENCE

Senior Research Fellow

Mayo Clinic

July 2023 - present

The Orthopedic Surgery Department

- Sustained active involvement in pioneering research within the dynamic intersection of biomechanics and robotics.
- Acquired valuable grant writing experience through collaboration with Dr. Kenton Kaufman and Dr. Alexander Shin.
- Actively participated in the submission of research proposals to prestigious institutions including NIH, NSF, DoD, and various foundations, demonstrating a strong command of the grant application process.

Research Fellow

Mayo Clinic

May 2021 - July 2023

The Orthopedic Surgery Department

- Acquired valuable research exposure under the guidance of Dr. Kenton Kaufman in the Motion Analysis Laboratory.
- Developed proficiency in executing clinical trials.
- Assisted in data collection, analysis, and interpretation, fostering a deeper understanding of biomechanics and motion analysis techniques.

Graduate Teaching Assistant

Arizona State University

August 2019 - December 2019

Ira A. Fulton Schools of Engineering

- Provided valuable support to instructors and students in the Mechanics and Strength of Materials courses (EGR 217 and EGR 343).
- Assisted in leading lectures, facilitating discussions, and conducting hands-on lab sessions.
- Graded assignments and exams, providing constructive feedback to enhance student understanding.

Graduate Teaching Assistant-Instructor of Record

Arizona State University

August 2018 - May 2019

Ira A. Fulton Schools of Engineering

- Taught the Computational Modelling of Engineering Systems course (course code: EGR 219).
- Guided undergraduate students through the complexities of Matlab, C, and other computational programming languages.

- Developed engaging lectures, assignments, and projects to foster a comprehensive understanding of the subject matter.
- Supported student learning by providing one-on-one assistance and constructive critique on coding practices.

Graduate Research Assistant

Arizona State University

August 2017 - December 2018

Ira A. Fulton Schools of Engineering

- Collaborated closely with Dr. Sangram Redkar and Dr. Thomas Sugar in the field of robotics and dynamical systems as a dedicated Ph.D. student.
- Successfully conceptualized, designed, and executed a Passive Prosthetic Ankle project funded by a Small Business Innovation Research grant.
- Proficiently operated and contributed to the development of robotics projects on the Universal Robots 5 and Baxter platforms.
- Demonstrated leadership by mentoring and guiding undergraduate students in their work involving the Universal Robots 5 and Baxter platforms.
- Actively participated in proposal development alongside Dr. Redkar, engaging in the creation of multiple proposals aimed at advancing research in the field.

Engineering Intern

NextGen Aeronautics

May 2017 - Dec 2018

- Tested a new markerless motion capture system and compared it against popular motion capture systems.
- Gained operational experience with a variety of motion capture systems.

HONORS/AWARDS

Kelly Research Fellowship

Department of Orthopedic Surgery, Mayo Clinic

2023-24

Rochester, MN, U.S.A.

- Received a one year fellowship for the project "Real World Data Based Surgical and Rehabilitation Outcome Measures".

Julian M. Bruner Award

American Society for Surgery of the Hand

2023

Toronto, Canada

- Received the award for outstanding poster on "Voluntary neuromuscular control of the Gracilis free functioning muscle transfer for elbow flexion: Spinal Accessory Nerve vs. Intercostal Nerve"

Outstanding Abstract and Poster

Department of Physiology and Biomedical Engineering, Mayo Clinic

2023

Rochester, MN, U.S.A.

- Received the award for outstanding abstract and poster on "Design and development of a powered elbow exoskeleton for neuromuscular injuries".

Clinical Bio-mechanics Award

North American Congress on Bio-mechanics

2022

Ottawa, Canada

- Received the award for outstanding new biomechanics research targeting a contemporary clinical problem on "Characterization of elbow flexion recovery following surgery for traumatic brachial plexus injury".

PROJECTS

Real World Data Based Surgical and Rehabilitation Outcome Measures

2022 - present

- Developed algorithms and protocols to objectively quantify outcomes after surgery and rehabilitation using wearable sensors.

Upper Extremity Exoskeleton

2021 - present

- Aided the development of a powered elbow exoskeleton for the Brachial Plexus Injury population.

Invariant Manifolds in Human Walking Gait

2019

- Worked on proving the existence of invariant manifolds in human walking data and its various applications. Used dynamical system theory, Lypunov-Floquet theory, and invariant manifold theory.

- Mechanical Design of an Elbow Exoskeleton** 2019
- Designed the mechanism for an elbow exoskeleton using Bowden cables. Prototyped the said design and conducted tests to judge its efficacy.
- Periodic Force Applied to the Hip During Normal Human Gait** 2018
- Applied a periodic force to the hip of several test subjects during normal gait. Collected various kinematic, kinetic, and physiological data for analysis to prove the effectiveness of such a force in reducing metabolic cost.
- Topology Optimization of Automotive Lower Control Arm** 2018
- Designed a lower control arm for automobile suspension. Optimized the design using Nastran-Patran to reduce the amount of mass and material used in manufacturing. Compared the design to a generic control arm.
- Application of Genetic Algorithm and Various Optimization Routines** 2018
- Developed a Genetic algorithm and various constrained and non constrained optimization routines to optimize the parameters for a curve fitting technique.
- Development of an IMU Based Motion Capture System** 2017 - 18
- Aided the development of an IMU based motion capture system. Tested and validated the system comparing it to various other optical, IMU, and magnetic motion capture systems.
- Design/Development of a Passive Prosthetic Ankle** 2017
- Designed a passive prosthetic ankle using coil springs in place of the Tibialis-Anterior and Gastrocnemius muscle groups. Developed a testing jig for healthy human subjects to wear the prosthesis and conducted various experiments.
- Hyper-loop Control System modelling and Simulations** 2017
- Designed the control system for the levitation system for a hyper-loop competition team. Modelled the control system on Simulink and Matlab for simulation purposes.

ORGANIZATIONAL POSITIONS

- Director of Outreach** August 2020 - April 2021
Graduate and Professional Student Association *Arizona State University*
- Organized events on the Polytechnic campus for the Graduate student body.
 - Acted as a point of communication for the campus administration and the student body.
- Engineering Assembly member** August 2019 - May 2020
Graduate and Professional Student Association *Arizona State University*
- Elected Assembly member for The Polytechnic School.
 - Served in the Engineering Committee and the Special Projects Committee.
- Student President** August 2015 - May 2016
Mechanical Engineering Students Association *Mumbai University affiliated college*
- Handled the day-to-day operations of the association.
 - Spearheaded a 2-tier team of 30 people to successfully conduct professional shows, exhibitions and talks for Yantram 2016 (a technical education event).
 - Organised event related to technical and professional advancement.
- Treasurer** August 2014 - May 2015
Mechanical Engineering Students Association *Mumbai University affiliated college*
- Handled the monetary operations and budgeting for the association.

SKILLS

Design and performance of clinical trials

Programming Skills (Matlab and Simulink, R, LabView, Python, C, C++, ROS, XML scripts, etc)

CAD/CAM (SolidWorks, Fusion 360, ProE.)

Operation of various Manipulator Arms (Baxter Dual-Arm Robot, UR5, Dobot Magician and self-built arm.)

Bio-mechanical Analysis (Open-Sim, Biomechanics toolkit.)

Motion Capture and Data Analysis (Vicon, Optitrack, IMU based systems.)

Embedded Systems

Fabrication of Various Devices

PUBLICATIONS

Characterization of elbow flexion torque after nerve reconstruction of patients with traumatic brachial plexus injury.

Sandesh G. Bhat, Eric J. Noonan, Griffin Mess, Emily J. Miller, Alexander Y. Shin, Kenton R. Kaufman.
Clinical Biomechanics.

DOI: 10.1016/j.clinbiomech.2023.105951

Muscle activation for targeted elbow force production following surgical reconstruction in adults with brachial plexus injury.

Sandesh G. Bhat, Emily J. Miller, Alexander Y. Shin, Kenton R. Kaufman.

Journal of Orthopaedic Research.

DOI: 10.1002/jor.25534

Order Reduction of Nonlinear Quasi-Periodic Systems Subjected to External Excitations.

Sandesh G. Bhat, Susheelkumar C Subramanian, Sangram Redkar.

International Journal of Non-Linear Mechanics.

DOI: 10.1016/j.ijnonlinmec.2022.103994

Applications of symbolically computed Lyapunov-Floquet transformation.

Susheelkumar C Subramanian, **Sandesh G. Bhat**, Sangram Redkar.

International Journal of Non-Linear Mechanics.

DOI: 10.1504/IJNDC.2022.124209

Dynamical Systems Theory and its Application to Human Gait Analysis

Sandesh G Bhat.

Ph.D. Dissertation, Arizona State University.

Application of Floquet Theory to Human Gait Kinematics and Dynamics.

Sandesh G. Bhat, Susheelkumar C Subramanian, Thomas G. Sugar, Sangram Redkar.

Journal of Mechanisms & Robotics.

DOI: doi.org/10.1115/1.4050199

Reconstruction Of Ground Reaction Force Data Using Lyapunov Floquet Theory And Invariant Manifold Theory.

Sandesh G. Bhat, Thomas G. Sugar, Sangram Redkar.

ASME 2020 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference.

DOI: 10.1115/DETC2020-22521

Invariant Manifolds In Human Joint Angle Analysis During Walking Gait.

Sandesh G. Bhat, Thomas G. Sugar, Sangram Redkar.

ASME 2020 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference.

DOI: 10.1115/DETC2020-22241

Design and Analysis of an Auto-Parametrically Excited Platform for Active Vibration Control.

Thao Le, **Sandesh G Bhat**, Susheelkumar C Subramanian, Peter MB Waswa, Sangram Redkar.

ASME 2019 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference.

DOI: 10.1115/DETC2019-97471

Analysis of a periodic force applied to the trunk to assist walking gait.

Sandesh G Bhat, Susheelkumar Cherangara, Jason Olson, Sangram Redkar, Thomas G. Sugar.
2019 Wearable Robotics Association Conference.

DOI: 10.1109/WEARRACON.2019.8719396

Volitional control of an active prosthetic ankle: a survey.

Sandesh G Bhat, Sangram Redkar.

International Robotics and Automation Journal 2018.

DOI: 10.15406/iratj.2018.04.00153

Design and Development of an Unmanned Underwater Vehicle (UUV) in the Form of a Cuttlefish.

Susheelkumar Cherangara Subramanian, Thao Le, Jason Olson, **Sandesh G Bhat**, Sangram Redkar.

ASME 2018 International Mechanical Engineering Congress and Exposition.

DOI: 10.1115/IMECE2018-86530

Development of a Passive Prosthetic Ankle With Slope Adapting Capabilities

Sandesh G Bhat, Sangram Redkar, Thomas G Sugar.

ASME 2018 International Mechanical Engineering Congress and Exposition.

DOI: 10.1115/IMECE2018-86593

Design and Development of a Passive Prosthetic Ankle

Sandesh G Bhat.

Master of Science Thesis, Arizona State University.