

# SANDESH G. BHAT, PH.D.

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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.

## 1. PRESENT ACADEMIC RANK AND POSITION

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### Senior Research Fellow

July 2023 - present

*Motion Analysis Laboratory, Mayo Clinic, Rochester, MN*

- 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.

## 2. EDUCATION

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### Arizona State University, Tempe, AZ

2021

Doctor of Philosophy

GPA: 4/4

Systems Engineering

### Arizona State University, Tempe, AZ

2017

Master of Science

GPA: 3.44/4

Mechanical Engineering

### University of Mumbai, Mumbai, India

2016

Bachelor of Engineering

CGPA: 7.71/10

Mechanical Engineering

## 3. HONORS/AWARDS

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### Kelly Research Fellowship

2023-24

*Department of Orthopedic Surgery, Mayo Clinic*

*Rochester, MN, U.S.A.*

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

### Finalist for the Jennifer Jowsey Research Fellow Award

2023

*Department of Orthopedic Surgery, Mayo Clinic*

*Rochester, MN, U.S.A.*

- Finalist for the Jennifer Jowsey outstanding Research Fellow award.

### Julian M. Bruner Award

2023

*American Society for Surgery of the Hand*

*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

2023

*Department of Physiology and Biomedical Engineering, Mayo Clinic*

*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

2022

*North American Congress on Bio-mechanics*

*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".

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#### 4. PREVIOUS PROFESSIONAL POSITIONS

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**Research Fellow** 2021 - 2023

*Motion Analysis Laboratory, Mayo Clinic, Rochester, MN*

- 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** 2019

*Arizona State University, Mesa, AZ*

- 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** 2018 - 2019

*Arizona State University, Mesa, AZ*

- 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** 2017 - 2018

*Arizona State University, Mesa, AZ*

- 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** 2017 - 2018

*NextGen Aeronautics, Torrance, CA*

- 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.

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#### 5. SERVICE

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##### COMMUNITY MEMBERSHIPS AND SERVICES

**Oraculi, Rochester, MN**

Mentor

2021 -2024

**Alliance of Chicanos, Hispanics, and Latin Americans (ACHLA), Rochester, MN**

Volunteer Mechanic

2023

## PEER REVIEW

### Ad hoc Reviewer

IEEE Transactions on Neural Systems and Rehabilitation Engineering	2024
Archives of Rehabilitation Research and Clinical Translation	2024
Annual Meeting of American Society of Biomechanics	2024
PLOS ONE	2024
International Conference on Robotics and Automation	2020
IEEE Robotics and Automation Letters	2020
International Conference on Intelligent Robots and Systems	2020

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## 6. PROFESSIONAL MEMBERSHIPS AND SOCIETIES

### Orthopedic Research Society (ORS)

Member 2023 - Present

### American Society for Biomechanics (ASB)

Member 2023 - Present

### The American Society of Mechanical Engineers (ASME)

Member 2018 - 2021

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## 7. EDUCATIONAL INTERESTS AND ACCOMPLISHMENTS

### TEACHING

#### Engineering Mechanics Fundamentals (EGR 217)

#### Mechanics of Solid Materials (EGR 343)

Fall 2019

*3 credits: In person teaching assistant*

*Arizona State University, Mesa, AZ*

- Provided valuable support to instructors and students
- Assisted in leading lectures, facilitating discussions, and conducting hands-on lab sessions.
- Graded assignments and exams, providing constructive feedback to enhance student understanding.

#### Computational Modeling of Engineering Systems (EGR 219)

Fall 2018 - Spring 2019

*3 credits: Lecturer (In person and hybrid)*

*Arizona State University, Mesa, AZ*

- 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.

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## 8. INSTITUTIONAL/DEPARTMENTAL ADMINISTRATIVE RESPONSIBILITIES

### Graduate and Professional Student Association, Arizona State University

Director of Outreach 2020 - 2021

Engineering Assembly member 2019 - 2020

### Mechanical Engineering Students Association, University of Mumbai

Student President 2015 - 2016

Treasurer 2014 - 2015

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## 9. PRESENTATIONS EXTRAMURAL

### ORAL PRESENTATION

Stability analysis for the quantitative assessment of progressive supranuclear palsy affected gait August 2023

American Society of Biomechanics 2023 Annual Meeting  
Knoxville, TN

Real-world evidence-based measurement of upper extremity activity June 2023

Gait and Clinical Movement Analysis Society 2023 Annual Meeting

High Point, NC

Invariant manifolds in human joint angle analysis during walking gait August 2020  
2020 International Mechanical Engineering Congress and Exposition  
Virtual Conference

Reconstruction of ground reaction force data using Lyapunov Floquet theory and August 2020  
invariant manifold theory  
2020 International Mechanical Engineering Congress and Exposition  
Virtual Conference

Development of a passive prosthetic ankle with slope adapting capabilities November 2018  
2018 International Mechanical Engineering Congress and Exposition  
Pittsburgh, PA

Design and development of an unmanned underwater vehicle (UUV) in the form of a cuttlefish November 2018  
2018 International Mechanical Engineering Congress and Exposition  
Pittsburgh, PA

### POSTER PRESENTATION

Voluntary neuromuscular control of gracilis free functioning muscle transfer for elbow flexion: February 2024  
Spinal Accessory Nerve vs Intercostal Nerve  
Orthopedic Research Society 2024 Annual Meeting  
Long Beach, CA

Design and development of a powered elbow exoskeleton for neuromuscular injuries August 2023  
2023 Military Health System Research Symposium  
Kissimmee, FL

Analysis of a periodic force applied to the trunk to assist walking gait March 2019  
2019 Wearable Robotics Association Conference  
Scottsdale, AZ

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## 10. RESEARCH INTERESTS

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Gait and Balance  
Application of Nonlinear dynamics to gait and balance  
Rehabilitation Science  
Translational Biomechanics  
Robotic Prosthetics/Orthotics and Exoskeleton

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## 11. BIBLIOGRAPHY

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Shared first authorship is marked by \*

### PEER REVIEWED ARTICLES

1. Vignola C\*, **Bhat SG\***, Hollander K, Kane P, Miller E, Martin W, Shin AY, Sugar TG, Kaufman KR. Design and development of a powered myoelectric elbow orthosis for neuromuscular injuries. *Military Medicine*. 2024 (accepted)
2. **Bhat SG**, Shin AY, Kaufman KR. Upper extremity asymmetry due to nerve injuries or central neurologic conditions: a scoping review. *Journal of neuroengineering and rehabilitation*. 2023 Nov 9;20(1):151.
3. **Bhat SG**, Miller EJ, Shin AY, Kaufman KR. Muscle activation for targeted elbow force production following surgical reconstruction in adults with brachial plexus injury. *Journal of Orthopaedic Research®*. 2023 Sep;41(9):2032-9.
4. **Bhat SG**, Noonan EJ, Mess G, Miller EJ, Shin AY, Kaufman KR. Characterization of elbow flexion torque after nerve reconstruction of patients with traumatic brachial plexus injury. *Clinical Biomechanics*. 2023 Apr 1;104:105951.
5. **Bhat SG**, Subramanian SC, Redkar S. Order reduction of nonlinear quasi-periodic systems subjected to external excitations. *International Journal of Non-Linear Mechanics*. 2022 Jun 1;142:103994.
6. Subramanian SC, **Bhat SG**, Redkar S. Applications of symbolically computed Lyapunov-Floquet transformation. *International Journal of Nonlinear Dynamics and Control*. 2022;2(2):97-115.

7. **Bhat SG**, Subramanian SC, Sugar TS, Redkar S. Application of Floquet theory to human gait kinematics and dynamics. *Journal of Mechanisms and Robotics*. 2021 Dec 1;13(6):061003.
8. **Bhat SG**, Sugar TG, Redkar S. Invariant manifolds in human joint angle analysis during walking gait. In *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference 2020 Aug 17* (Vol. 83914, p. V002T02A031). American Society of Mechanical Engineers.
9. **Bhat SG**, Sugar TG, Redkar S. Reconstruction of ground reaction force data using Lyapunov Floquet theory and invariant manifold theory. In *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference 2020 Aug 17* (Vol. 83990, p. V010T10A047). American Society of Mechanical Engineers.
10. Le T, **Bhat SG**, Subramanian SC, Waswa PM, Redkar S. Design and analysis of an auto-parametrically excited platform for active vibration control. In *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference 2019 Aug 18* (Vol. 59261, p. V006T09A046). American Society of Mechanical Engineers.
11. **Bhat SG**, Cherangara S, Olson J, Redkar S, Sugar TG. Analysis of a periodic force applied to the trunk to assist walking gait. In *2019 Wearable Robotics Association Conference (WearRAcon) 2019 Mar 25* (pp. 68-73). IEEE.
12. **Bhat SG**, Redkar S, Sugar TG. Development of a passive prosthetic ankle with slope adapting capabilities. In *ASME International Mechanical Engineering Congress and Exposition 2018 Nov 9* (Vol. 52026, p. V003T04A018). American Society of Mechanical Engineers.
13. Cherangara Subramanian S, Le T, Olson J, **Bhat SG**, Redkar S. Design and Development of an Unmanned Underwater Vehicle (UUV) in the Form of a Cuttlefish. In *ASME International Mechanical Engineering Congress and Exposition 2018 Nov 9* (Vol. 52040, p. V04BT06A020). American Society of Mechanical Engineers.
14. **Bhat SG**, Redkar S. Volitional control of an active prosthetic ankle: a survey. *International Robotics and Automation Journal*. 2018 Nov 27;4:380-8.

## ABSTRACTS

1. **Bhat SG**, Shin AY, Kaufman KR. Voluntary neuromuscular control of gracilis free functioning muscle transfer for elbow flexion: spinal accessory nerve vs intercostal nerve. In *Orthopedic Research Society 2024 Annual Meeting, February 2024, Long Beach, CA; Paper No. 1166*
2. **Bhat SG**, Shin AY, Kaufman KR. Voluntary neuromuscular control of gracilis free functioning muscle transfer for elbow flexion: spinal accessory nerve vs intercostal nerve. In *Scientific ePoster Abstract Book, American Society for Surgery of the Hand, October 2023, Toronto, Canada; p 42, ePoster 20*
3. **Bhat SG**, Ali F, Hogen CA, Josephs KA, Whitwell J, Kaufman KR. Stability analysis for quantitative assessment of progressive supranuclear palsy affected gait. In *Orals Part 1, American Society of Biomechanics, August 2023, Knoxville, TN; p 5*.
4. Noonan EJ, **Bhat SG**, Mess G, Miller EJ, Kane P, Shin AY, Kaufman KR. Characterization of elbow flexion recovery following surgery for traumatic brachial plexus injury. In *North American Congress on Biomechanics, August 2022, Ottawa, Canada; Winner of Clinical Biomechanics Award*.
5. **Bhat SG**, Shin AY, Kaufman KR. Real-world evidence of upper extremity asymmetry. In *North American Congress on Biomechanics, August 2022, Ottawa, Canada; Poster P1-189*

## THESIS

1. **Bhat SG**. *Dynamical Systems Theory and its Application to Human Gait Analysis*. Doctoral dissertation, Arizona State University; 2021.
2. **Bhat SG**. *Design and Development of a Passive Prosthetic Ankle*. Master's Thesis, Arizona State University; 2017.