# Soha Niroumandijahromi

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## EDUCATION

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|---|---|
| 2021 – Present | **University of Southern California**, Los Angeles, CA<br>Ph.D. Mechanical and Medical Engineering |
| 2023 – 2025 | **University of Southern California**, Los Angeles, CA<br>M.Sc. Computer Science |
| 2021 – 2023 | **University of Southern California**, Los Angeles, CA<br>M.Sc. Mechanical Engineering |
| 2016 – 2019 | **University of Tehran**, Tehran, Iran<br>M.Sc. Aerospace and Mechanical Engineering |
| 2011 – 2016 | **Yazd University**, Yazd, Iran<br>B.S. Mechanical Engineering |

## RESEARCH INTERESTS

Smartphone & Wearable Physiological Signal Acquisition · Signal Processing & Time–Frequency Analysis for Physiological Waveforms · Machine Learning & Deep Learning · Physics- and Physiology-Informed Machine Learning · Spectral Methods

## ACADEMIC AND PROFESSIONAL EXPERIENCE

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| 2023 – 2025 | American Heart Association Predoctoral Fellow<br>Department of Mechanical Engineering,<br>University of Southern California, Los Angeles, CA |
| 2021 – 2023 | Research Assistant<br>Department of Mechanical Engineering,<br>University of Southern California, Los Angeles, CA |

## HONORS AND AWARDS

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| 2025 | **2025 Rising Star in Mechanical Engineering, MIT, [Link]** |
| 2025 | **American Heart Association Scientific Sessions Early Innovators Spotlight** |
| 2025 | **Phi Kappa Phi Student Recognition Award University of Southern California, [Link]**<br>Awarded to only two graduate students each year across the entire university. |
| 2025 | **Finalist, Best Abstract Award - North American Artery Conference 2025** |

2024 **American Heart Association Predoctoral Fellowship Award, [Link]**

2023 **American Heart Association Scientific Sessions 2023 Travel Grant**

## JOURNAL PUBLICATIONS

**11. Niroumandi S**, Rinderknecht D, Bilgi C, Cole S, Ogbonnaya SA, Wolfson AM, Vaidya AS, King KS, and Pahlevan NM. (2025). "Smartphone Measurement of Aortic Arch Pulse Wave Velocity and Total Arterial Compliance: Accessible Local and Global Arterial Stiffness Assessment". Journal of the American Heart Association, Accepted.

**10. Niroumandi S**, Wei H, Amlani F, Gorji MH, Alavi R, Chirinos JA, Pahlevan NM. Time-Frequency Machine Learning Transfer Function for Central Pressure Waveforms. *European Heart Journal Open*. 2025 Jun 23:oeaf082.
https://doi.org/10.1093/ehjopen/oeaf082

**9. Niroumandi S**, Alavi R, Wolfson AM, Vaidya AS, Pahlevan NM. Assessment of aortic characteristic impedance and arterial compliance from non-invasive carotid pressure waveform in the Framingham heart study. *The American Journal of Cardiology*. 2023 Oct 1;204:195-9.
https://doi.org/10.1016/j.amjcard.2023.07.076

**8.** Alavi R, Aghilinejad A, Wei H, **Niroumandi S**, Wieman S, Pahlevan NM. A coupled atrioventricular-aortic setup for in-vitro hemodynamic study of the systemic circulation: Design, fabrication, and physiological relevancy. *PLOS ONE*. 2022 Nov 4;17(11):e0267765.
https://doi.org/10.1371/journal.pone.0285228

**7.** Shojaeifard M, **Niroumandi S**, Baghani M. Swelling of pH-sensitive hydrogel pressure vessel under altered-pH coupled with inflation, extension, and torsion. *Meccanica*. 2022 Jun;57(6):1391-411.
https://doi.org/10.1007/s11012-022-01497-6

**6.** Shojaeifard M, **Niroumandi S**, Baghani M. Programmable self-folding of trilayer and bilayer-hinge structures by time-dependent swelling of tough hydrogels. *Journal of Intelligent Material Systems and Structures*. 2022 Sep;33(16):2106-20.
https://doi.org/10.1177/1045389X221077435

**5.** Shojaeifard M, **Niroumandi S**, Baghani M. pH-Responsive Hydrogel Bilayer with Reversible, Bidirectional Bending Behavior. *Frontiers in Materials*. 2022 May 26;9:865652.
https://doi.org/10.3389/fmats.2022.865652

**4. Niroumandi S**, Shojaeifard M, Baghani M. On single and multiple pH-sensitive hydrogel micro-valves: a 3D transient fully coupled fluid–solid interaction study. *Transport in Porous Media*. 2022 Mar;142(1-2):295-316.
https://doi.org/10.1007/s11242-021-01625-y

**3. Niroumandi S**, Shojaeifard M, Baghani M. PH-sensitive hydrogel-based valves: A transient fully-coupled fluid-solid interaction study. *Journal of Intelligent Material Systems and Structures*. 2022 Jan;33(1):196-209.
https://doi.org/10.1177/1045389X211011671

**2.** Shojaeifard M, **Niroumandi S**, Baghani M. Programming shape-shifting of flat bilayers composed of tough hydrogels under transient swelling. *Acta Mechanica*. 2022 Jan;233(1):213-32.
https://doi.org/10.1007/s00707-021-03117-y

**1. Niroumandi S**, Shojaeifard M, Baghani M. Finite deformation of swollen pH-sensitive hydrogel cylinder under extension and torsion and its Poynting effect: analytical solution and numerical verification. *International Journal of Applied Mechanics*. 2021 Jul 20;13(06):2150071.
https://doi.org/10.1142/S175882512150071

## PEER-REVIEWED CONFERENCE PROCEEDING PUBLICATIONS

**11. Niroumandi S,** Alavi R, Pahlevan N. Association Between Healthy Vascular Aging and Intrinsic Frequencies of Carotid Pressure Waveform: The Framingham Heart Study. Circulation. 2025 Nov 4;152(Suppl_3):A4373355-.
https://doi.org/10.1161/circ.152.suppl_3.4373355

**10. Niroumandi S,** Rinderknecht D, Bilgi C, Cole S, Ogbonnaya S, Wolfson A, Vaidya A, King K, Pahlevan N. Noninvasive Assessment of Left Ventricular Pulsatile Workload Using Smartphone-Measured Carotid Waveforms. Circulation. 2025 Nov 4;152(Suppl_3):A4368010-.
https://doi.org/10.1161/circ.152.suppl_3.4368010
**9. Niroumandi S,** Alavi R, Pahlevan N. Association Between Intrinsic Frequencies of Carotid Pressure Waveforms and AHA Cardiovascular Health Score: The Framingham Heart Study. Circulation. 2025 Nov 4;152(Suppl_3):A4370582-.
https://doi.org/10.1161/circ.152.suppl_3.4370582
**8. Niroumandi S,** Wei H, Wolfson A, Vaidya A, Pahlevan N. Cardiac Output Assessment from Intrinsic Frequencies of a Single Carotid Pressure Waveform in a Large Community-Based Population: The Framingham Heart Study. Circulation. 2025 Nov 4;152(Suppl_3):A4368070-.
https://doi.org/10.1161/circ.152.suppl_3.4368070
**7.** Vaidya AS, **Niroumandi S**, Mazandarani SP, Wolfson AM, and Pahlevan NM. (2024). "Left Ventricle Pulsatile Workload from A Single Pressure Waveform Using Physics-Based Machine Learning Approach and Cardiovascular Disease Events in The Framingham Heart Study". *Journal of the American College of Cardiology*. 83(13): 2451-2451.
https://doi.org/10.1016/S0735-1097(24)04441-3
**6.** Vaidya AS, **Niroumandi S**, Mazandarani SP, Wolfson AM, and Pahlevan NM. (2024). "Single Pressure Waveform Calculation of Total Arterial Compliance Predict Heart Failure Events in Framingham Heart Study". *Journal of the American College of Cardiology*. 83(13): 712-712.
https://doi.org/10.1016/S0735-1097(24)02702-5
**5.** Vaidya AS, **Niroumandi S**, Mazandarani SP, Wolfson AM, and Pahlevan NM. (2024). "Prognostic Value of Aortic Characteristic Impedance Calculated from A Single Carotid Waveform Using Hybrid Intrinsic Frequency-Machine Learning Approach". Journal of the American College of Cardiology. 83(13): 1988-1988.
https://doi.org/10.1016/S0735-1097(24)03978-0
**4.** Liu J, **Niroumandi S**, Petrasek D, and Pahlevan NM. (2023). "Non-Invasive Insulin Resistance Evaluation Using Carotid Pressure Waveforms in Framingham Heart Study". Circulation. 148: A16533-A16533
https://www.ahajournals.org/doi/abs/10.1161/circ.148.suppl_1.16533
**3. Niroumandi S**, Rinderknecht D, Bilgi C, Wolfson A, Vaidya A, King KS, and Pahlevan NM. (2023). "A Noninvasive Smartphone Assessment of Aortic Arch Pulse Wave Velocity and Total Arterial Compliance". Circulation. 148: A18846-A18846
https://www.ahajournals.org/doi/abs/10.1161/circ.148.suppl_1.18846.
**2. Niroumandi S**, Wolfson AM, Vaidya AS, and Pahlevan NM. (2023). "Evaluation Of Left Ventricular Pulsatile Workload In Heart Failure With Preserved Ejection Fraction Using A Single Pressure Waveform Form Framingham Heart Study". Hypertension. 80:AP367
https://doi.org/10.1161/hyp.80.suppl_1.P367
**1. Niroumandijahromi S**, Vaidya A, Pahlevan NM. (2022) "Hybrid Intrinsic Frequency Machine Learning Approach for Calculation of Total Arterial Compliance and Aortic Characteristic Impedance from A Single Carotid Waveform in Heart Failure With Preserved Ejection Fraction". Hypertension. 79: A039-A039.
https://doi.org/10.1161/hyp.79.suppl_1.039

## PATENTS

**1.** Alavi R, Amlani F, Gorji H, **Niroumandijahromi S**, Heng Wei H, and Pahlevan NM. (2024). "Sequentially-Reduced Artificial Intelligence Based Systems And Methods For Cardiovascular Transfer Functions" (US-20230138773-A1).
**https://ppubs.uspto.gov/dirsearch-public/print/downloadPdf/20240138773**

## GRANTS

**1.** American Heart Association (AHA) predoctoral fellowship award
Period: 01/01/2024-12/31/2025
Amount: $67,388.00
Role: PI

Title: A Noninvasive Smartphone-based Approach for Assessment of Dementia Risk Predictors Using Arterial Pressure Waveform

## INVITED LECTURES & SEMINARS

**1.** "The Role of Left Ventricular–Arterial Interactions on Coronary Fluid Dynamics," *AME Seminar Series*, Department of Aerospace & Mechanical Engineering, University of Southern California, Los Angeles, CA, February 2026.

## CLINICAL TRIALS AND STUDIES

**1. "**A Noninvasive, inexpensive intervention for heart failure patients to reduce morbidity, hospitalizations, and improve quality of life."

Location: University of Southern California,
Keck Medical School and Viterbi School of Engineering
Time Period: 2023-2027
Role: Co-Investigator
Principal Investigators: Ajay Vaidya, MD, Niema Pahlevan, PhD
Collaborating Investigator: Aaron Wolfson MD

## CONFERENCE PRESENTATIONS

**7.** Bilgi C, **Niroumandi S,** King K, Pahlevan N**, "**Physics-Based Machine Learning Approach for Assessing Pulsatile Energy Transmission and Cardiac Output Distribution to Brain Using Only Carotid Pressure Waveform". *North American Artery 13th Annual Meeting*, June 27-28, 2025; Philadelphia, PA.

**6. Niroumandi S**, Bilgi C, King K, Pahlevan N**, "**White Matter Hyperintensity and Whole Brain Cerebrovascular Reactivity Can Be Estimated from Non-Invasive Carotid Pressure Waveforms". *North American Artery 13th Annual Meeting*, June 27-28, 2025; Philadelphia, PA.

**5. Niroumandi S**, Rafiei D, Geng H, Rinderknecht De, Pahlevan N**, "**Calibration Refinement of Cuff Pressure Devices Using a Controlled, Physiologically Accurate In-vitro Systemic Circulatory Setup". *American Physical Society (APS) Global Physics Summit*, March 16-21, 2025; Anaheim, CA.

**4. Niroumandi S**, Amlani F, Matthews R, and Pahlevan NM. (2023) "The Influence of Left Ventricle and Aorta Interactions on the Coronary Blood Flow Using One-Dimensional Model of Hemodynamics and Wave Propagation in the Entire Circulatory System". *American Physical Society Division of Fluid Dynamics (APS-DFD),* 76th Annual Meeting, Washington, DC.

**3.** Alavi R, Aghilinejad A, Wei H, **Niroumandi S**, Wieman S, Pahlevan N. "In-vitro coupled left atrioventricular-aortic hemodynamic simulator for systemic circulation". *American Physical Society Division of Fluid Dynamics (APS-DFD),* 74th Annual Meeting, Phoenix, AZ.

**2. Niroumandi S**, Alavi R, Pahlevan N. "A Machine Learning Methodology for estimation of vascular characteristics using a single carotid waveform". *American Physical Society Division of Fluid Dynamics (APS-DFD),* 74th Annual Meeting, Phoenix, AZ.

**1. Niroumandi S**, Jafari A, Vakilipour S. "3-D simulation of pulsatile blood flow using a haemorheological model". Annual European Rheology Conference (AERC) 2019, Portoroz, Slovenia.

## MENTORING

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| **University of Southern California K-12 STEM Center Outreach** | 12 High School Students from 2022-2024 |
| **NSF Summer Research Program** | 2 High School Students 2023 |

## ACADEMIC SERVICES

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| **NSF Outreach** | 5 visits for Gardena Highschool students starting 2023 to 2025 |