

Soha Nirooumandijahromi

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EDUCATION

- 2021 – Present **University of Southern California**, Los Angeles, CA
Ph.D. Mechanical and Medical Engineering
- 2023 – 2025 **University of Southern California**, Los Angeles, CA
M.Sc. Computer Science
- 2021 – 2023 **University of Southern California**, Los Angeles, CA
M.Sc. Mechanical Engineering
- 2016 – 2019 **University of Tehran**, Tehran, Iran
M.Sc. Aerospace and Mechanical Engineering
- 2011 – 2016 **Yazd University**, Yazd, Iran
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 in Computational Fluid Dynamics · Rheology of Complex Fluids · Soft and Smart Materials

ACADEMIC AND PROFESSIONAL EXPERIENCE

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

HONORS AND AWARDS

- 2025 **2025 Rising Star in Mechanical Engineering, MIT**
- 2025 **American Heart Association Scientific Sessions Early Innovators Spotlight**
- 2025 **Phi Kappa Phi Student Recognition Award University of Southern California**
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**

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

JOURNAL PUBLICATIONS

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

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. Shoaefard 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. Shoaefard 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. Shoaefard 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, Shoaefard 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, Shoaefard 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. Shoaefard 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, Shoaefard 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](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](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](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

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

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

NSF Outreach

5 visits for Gardena Highschool students starting 2023 to 2025