

Summary: My research is focused on combining machine learning and constitutive modeling of soft materials. In contrast to most other research in the literature, my modeling approach is characterized by embedding the relevant physics into the formulation of the problem. For example, I developed models of hyperelasticity and viscoelasticity where the conditions of polyconvexity and positivity of energy dissipation are satisfied exactly.

EDUCATION

PhD [Purdue University](#), West Lafayette, IN

2021 - now *Mechanical Engineering*

Dissertation title: Data-driven modeling of biological materials

MSc [Middle East Technical University](#), Ankara, Turkey

2016 - 2019 *Aerospace Engineering*

Thesis title: Micromechanical modeling of carbon nanotube – polymer composites

BSc [Middle East Technical University](#), Ankara, Turkey

2012 - 2016 *Aerospace Engineering*

AWARDS & HONOURS

- **TRAVel for Collaborative Research (TRACER) Award (\$10,000)**. I was one of the 5 PhD students and postdocs to receive Purdue University's inaugural TRACER award for travel to Stanford University for a collaboration.
- **SES Travel Award (\$1,000)** from Society of Engineering Science (SES) to attend the Inaugural SES Future Faculty Symposium, 2023.
- **Robert J. Melosh Medal** for best student paper in computational solid mechanics, Duke University, 2022.
- **Ward A. Lambert Graduate Fellowship**, Purdue University, 2022
- **Ben M. Hillberry Graduate Scholarship (\$3,600)**, Purdue University, 2022.
- **TUBITAK Publication Award**, 2020.
- **3rd Place**, Individual Aircraft Design Competition 2015-16, American Institute of Aeronautics and Astronautics (AIAA).
- **1st Place**, METU Engineering Day 2016 Poster Competition.
- **Full scholarship** from the Ministry of Higher Education of Afghanistan for undergraduate studies in Turkey, covering all expenses.

PUBLICATIONS

- [8] **V. Tac**, M. K. Rausch, I. Bilonis, F. S. Costabal and A. B. Tepole, “*Generative hyperelasticity with physics-informed probabilistic diffusion fields*,” *Submitted*, 2023.

- [7] V. Tac, M. K. Rausch, F. S. Costabal and A. B. Tepole, “*Data-driven anisotropic finite viscoelasticity using neural ordinary differential equations*,” *Computer Methods in Applied Mechanics and Engineering*, 2023.
- [6] V. Tac, K. Linka, F. S. Costabal, E. Kuhl and A. B. Tepole, “*Benchmarks for physics-informed data-driven hyperelasticity*,” *Computational Mechanics*, 2023.
- [5] V. Tac, F. S. Costabal, and A. B. Tepole, “*Data-driven tissue mechanics with polyconvex neural ordinary differential equations*,” *Computer Methods in Applied Mechanics and Engineering*, 2022.
- [4] V. Tac, V. D. Sree, M. K. Rausch, and A. B. Tepole, “*Data-driven modeling of the mechanical behavior of anisotropic soft biological tissue*,” *Engineering with Computers*, 2022.
- [3] Y. Leng, V. Tac, S. Calve, and A. B. Tepole, “*Predicting the mechanical properties of biopolymer gels using neural networks trained on discrete fiber network data*,” *Computer Methods in Applied Mechanics and Engineering*, 2021.
- [2] V. Tac, and E. Gürses, “*Micromechanical modelling of carbon nanotube reinforced composite materials with a functionally graded interphase*,” *Journal of Composite Materials*, 2019.
- [1] W. Taj and D. Coker, “*Dynamic frictional sliding modes between two homogenous interfaces*”, IOP Conference Series: Materials Science and Engineering, 2018.

TEACHING

- ME 270 - Statics** I was the instructor for one of the sections of ME 270 – Basic Mechanics I as
Fall 2023 part of the Ward A. Lambert Teaching Fellowship.
- ME 270 - Statics** I taught a few sessions of the class in preparation for my Fall 2023 class.
Spring 2023

EXPERIENCE

Purdue University **Research Assistant**
2021 - now

- Research on developing data-driven models of hyperelasticity and viscoelasticity. Developed two data-driven models of hyperelasticity using Feed-Forward Neural Networks and Neural ODEs. Developed the first fully data-driven, physics-informed model of anisotropic finite viscoelasticity.

Turkish Aerospace **Structural Design Engineer**
2018 - 2021

- Designed various spacecraft parts such as structural panels, inserts and brackets. Spearheaded the development of the first structural panel with embedded active cooling in TAI.

TUBITAK Space Technologies Research Institute **Research Engineer**
2017 - 2018

- Developed two engineering software packages for 1) conceptual aircraft design and 2) prediction of failure modes of composite materials.

SKILLS

- Finite Element Method
- Machine learning & Optimization
- Programming languages such as Python & FORTRAN
- Visualization

- Familiarity with a variety of tools and languages such as **Julia**, **Visual Basic**, **MATLAB**, **C**, **HTML**, **Javascript**, **PHP**, **L^AT_EX** and others.