



# MEHRAN EBRAHIMI

Computational Physics and Numerical Simulation Specialist

## CONTACT

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## STRENGTHS

- Physical Simulation
- Finite Element Analysis
- Numerical Analysis
- Mathematical Optimization
- Graph Convolutional Networks
- Deep Learning

## CODING SKILLS

- C/C++
- Python
- PyTorch
- TensorFlow
- DGL

## CAE SOFTWARE

- Ansys
- Autodesk Nastran
- HyperWorks
- SolidWorks
- Inventor
- AutoCAD

## WORK EXPERIENCE

**Principal Research Scientist**  
**Autodesk Research**

Nov 2015 - Present

- Conducting research and developing software prototypes for high-fidelity numerical simulation of physical phenomena. Sample projects:
  - Project Dreamcatcher: a generative design platform for automated design of mechanical components
  - FibraGen: a hybrid kinematics-structural solver for draping simulation of fiber-reinforced composites (C/C++)
  - Momentum: a simulation optimization engine for flexible multi-body dynamics (C/C++)
  - RoboSoft: a forward/inverse kinematics solver for industrial robots (Python)
  - Created a nonlinear model for sheet metal forming simulations using one-step inverse finite element approach (C/C++)
  - Developed generative design models for automating the design of multi-component mechanical assemblies, gearboxes, soft robots
  - Created a nonlinear material model for forming simulation of fiber-reinforced composites using finite element method
- Incorporating AI/ML/Reduced-order models for accelerating numerical simulations
  - Developed a deep learning model for predicting the elastic material properties of micro-lattices (TensorFlow, PyTorch, DGL)
- Publishing and presenting in relevant scientific journals and conferences

**Development Engineer**  
**Array Marketing**

Apr 2015 - Nov 2015

- Designed epoxy molds for vacuum forming of polystyrene sheets exploited in retail display fixtures
- Prepared manufacturable 2D and 3D planograms and technical drawings using AutoCAD and Solidworks
- Constructed BOMs of design assemblies and assisting the Design and Development department to optimize the fabrication costs
- Planning fabrication procedure of display fixtures to deliver cost-effective solutions as per customers' expectations

## EDUCATION

### Jan 2021 - Present

#### PhD in Aerospace Science & Engineering

University of Toronto

Thesis Title: TBD

### May 2013 - Apr 2015

#### M.A.Sc. in Mechanical Engineering

University of Toronto

Thesis Title: Design and Optimization of Aluminum Cross-Car Beam Assemblies Considering Uncertainties

### Sep 2009 - Sep 2011

#### M.Sc. in Mechanical Engineering

Sharif University of Technology

Thesis Title: Introducing a set of material strain measures in non-linear kinematics of micro-polar continuum mechanics and determining their rates

### Sep 2005 - Sep 2009

#### B.Sc. in Mechanical Engineering

Sharif University of Technology

## LEADERSHIP & MANAGEMENT

### June 2013 - June 2014

#### Representative of MIE Graduate Students

University of Toronto

### Sep 2009 - Sep 2010

#### Editor in Chief of Namehmech Sharif Magazine

Sharif University of Technology

## Mechanical Design Engineer

### Van-Rob Inc.

Sep 2013 - Jan 2015

- Implemented topology optimization techniques to obtain the conceptual design of CCBs and applied shape and size optimization procedures simultaneously on the conceptual design to get the detailed design
- Integrated AutoCAD and SolidWorks with Ansys to design instrument panel sub-systems
- Proposed a novel optimization framework for conceptual and detailed design of automotive aluminum cross-car beam (CCB) assemblies
- Tested the proposed optimization architecture on a CCB manufactured in the company, and could reduce the weight by approximately 21 % which led to 16% cost saving per CCB

## Co-Founder

### Saman Pajouhan Sharif (SPS) Corp.

July 2010 - Sep 2012

The main business area of the company was the design and manufacturing of film making equipment. Followings are a few projects that the company was involved in

- Fabrication of aluminum ENG Rigs (FigRig), a type of camera stabilizer
- Conceptual design of a Steadicam, a passive camera stabilizer

## SELECTED PUBLICATIONS & PATENTS

- Optimal Design of Continuum Robots With Reachability Constraints, IEEE Robotics and Automation Letters, 2021
- A low order, torsion-deformable spatial beam element based on the absolute nodal coordinate formulation and Bishop frame, Multibody System Dynamics, 2020
- Configuration Design of Mechanical Assemblies using an Estimation of Distribution Algorithm and Constraint Programming, IEEE Congress on Evolutionary Computation (CEC), 2019
- Design optimization of dynamic flexible multibody systems using the discrete adjoint variable method, Computers & Structures, 2019
- Three-Dimensional Numerical Flow Simulation of Resin Transfer Molding Process With Draping Analysis, ANTEC, 2017
- A Novel Approach for Design and Optimization of Automotive Aluminum Cross-Car Beam Assemblies, SAE Technical Paper, 2015
- Hybrid structural-geometric technique for performing draping simulation of woven fabric composites, 2019 (pending)
- Constraint-oriented programming approach to mechanical assembly design, 2019 (pending)
- Techniques for applying generative design to the configuration of mechanical assemblies, 2019 (pending)