Mehran **Ebrahimi**

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Education

University of Toronto — *Toronto, Canada*

PhD in Aerospace Science & Engineering — *Jan 2021-Present*

- **Supervisor**: Dr. Masayuki Yano
- **Thesis topic**: Model Order Reduction is Structural Simulation and Optimization

University of Toronto — *Toronto, Canada*

M.A.Sc. in Mechanical Engineering — *May 2015*

- **Supervisor**: Prof. Kamran Behdinan
- **Thesis title**: Design and Optimization of Aluminum Cross-Car Beam Assemblies Considering Uncertainties
- **GPA**: 4.0 / 4.0

Sharif University of Technology — *Tehran, Iran*

M.Sc. in Mechanical Engineering — *September 2011*

- **Supervisor**: Prof. Mohsen Asghari
- **Thesis title**: Introducing a set of material strain measures in non-linear kinematics of micro-polar continuum mechanics and determining their rates
- **GPA**: 18.38 / 20.00

Sharif University of Technology — *Tehran, Iran*

B.Sc. in Mechanical Engineering — *September 2009*

- **GPA**: 17.85 / 20.00

Honors & Awards

2014	**NSERC Scholarship for Master Studies**, University of Toronto	*Toronto, Canada*
2014	**Wallberg Fellowship**, University of Toronto	*Toronto, Canada*
2013	**University of Toronto's Fellowship for M.A.Sc.**, University of Toronto	*Toronto, Canada*
2011	**Ranked top 10 in M.Sc. of Mechanical Engineering**, Sharif University of Technology	*Tehran, Iran*
2009	**Ranked top 10 in B.Sc. of Mechanical Engineering**, Sharif University of Technology	*Tehran, Iran*

Publications

Journal papers

- H. Cheong, **M. Ebrahimi**, and T. Duggan, "Optimal design of continuum robots with reachability constraints", IEEE Robotics and Automation Letters, 2021.
- **M. Ebrahimi**, A. Butscher, and H. Cheong, "A low order, torsion-deformable spatial beam element based on the absolute nodal coordinate formulation and Bishop frame", Multibody System Dynamics, 2020.
- **M. Ebrahimi**, A. Butscher, H. Cheong, and F. Iorio, "Design optimization of dynamic flexible multibody systems using the discrete adjoint variable method", Computers & Structures, 213 (2019): 82-99.
- **M. Ebrahimi**, and K Behdinan, "A Novel Approach for Design and Optimization of Automotive Aluminum Cross-Car Beam Assemblies". No. 2015-01-1370. SAE Technical Paper, 2015.

Conference papers

- C. Piacentini, H. Cheong, **M. Ebrahimi**, and A. Butscher, "Multi-speed Gearbox Synthesis using Global Search and Non-Convex Optimization", 17th International Conference on the Integration of Constraint Programming, Artificial Intelligence, and Operations Research (CPAIOR), 2020.
- H. Cheong, **M. Ebrahimi**, A. Butscher, and F. Iorio, "Configuration Design of Mechanical Assemblies using an Estimation of Distribution Algorithm and Constraint Programming", 2019 IEEE Congress on Evolutionary Computation (CEC). IEEE, 2019.
- **M. Ebrahimi**, and M. Thorn, "Hybrid Finite Element-Geometric Forming Simulation of Composite Materials", The Composites and Advanced Materials Expo (CAMX), 2018.
- **M. Ebrahimi**, and M. Moruzzi, "Generative Design and Composite Materials: the path to reshape the Construction industry", JEC Conference, 2017.

- S. Han, **M. Ebrahimi**, and M. Moruzzi, D. Kenik, “Three-Dimensional Numerical Flow Simulation of Resin Transfer Molding Process With Draping Analysis”, ANTEC Conference, 2017.
- **M. Ebrahimi**, and K. Behdinan, “Evaluation of Metaheuristic Optimization Algorithms in Structural Applications”, The Canadian Society for Mechanical Engineering, 2014.
- **M. Ebrahimi**, and M. Asghari, “Dunford-Taylor Integral and the Isotropic Tensor Valued Functions Having the Commutative Property with their Tensor Argument”, Advanced Materials Research, 2012.

Patents

- **M. Ebrahimi**, H. Cheong, and A. Butscher, “Singularity-free kinematic parametrization of soft robot manipulators”, US Patent, 2020 (pending).
- **M. Ebrahimi**, A. Butscher, and H. Cheong, “ANCF14: A novel low order, torsion-deformable spatial beam element based on absolute nodal coordinate formulation and Bishop frame”, US Patent, 2020 (pending).
- H. Cheong, **M. Ebrahimi**, and A. Butscher, “Generative design of soft robot arms”, US Patent, 2020 (pending).
- H. Cheong, **M. Ebrahimi**, A. Butscher, and F. Iorio, “Techniques for applying generative design to the configuration of mechanical assemblies”, US Patent, 2019 (pending).
- H. Cheong, **M. Ebrahimi**, and A. Butscher, “Generative design of mechanical assemblies using an estimation of distribution algorithm”, US Patent, 2019 (pending).
- H. Cheong, **M. Ebrahimi**, and A. Butscher, “Visualization of probabilistic knowledge acquired during generative design of mechanical assemblies”, US Patent, 2019 (pending).
- **M. Ebrahimi**, A. Butscher, H. Cheong, and F. Iorio, “Efficient sensitivity analysis for generative parametric design of dynamic mechanical assemblies”, US Patent, 2019 (pending).
- **M. Ebrahimi**, M. Moruzzi, and F. Iorio, “Hybrid structural-geometric technique for performing draping simulation of woven fabric composites”, US Patent, 2019 (pending).
- H. Cheong, **M. Ebrahimi**, A. Butscher, and F. Iorio, “Constraint-oriented programming approach to mechanical assembly design”, US Patent, 2019 (pending).

Work Experience

Autodesk Research — *Toronto, Canada*

Principal Research Scientist — *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 and optimization engine for flexible multibody 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

Array Marketing — *Toronto, Canada*

Development Engineer — *May 2015 - Sep. 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

Saman Pajouhan Sharif (SPS) Corp. *Tehran, Iran*

Co-Founder *July 2010 - Sep. 2012*

- The main business area of the company was the design and manufacturing of film production 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

Teaching Experience

Teaching Assistant: Kinematics and Dynamics of Machines *Toronto, Canada*

University of Toronto *Sep. 2014*

Teaching Assistant: Mechanics of Solids I *Toronto, Canada*

University of Toronto *Jan. 2014*

Teaching Assistant: Statics *Tehran, Iran*

Sharif University of Technology *Jan. 2011*

Teaching Assistant: Machine Design II *Tehran, Iran*

Sharif University of Technology *Sep. 2010*

Teaching Assistant: Statics *Tehran, Iran*

Sharif University of Technology *Jan. 2010*

Teaching Assistant: Measurement and Control Systems *Tehran, Iran*

Sharif University of Technology *Sep. 2008*

Voluntary Activities

Associate Editor

Simulation: Transactions of The Society for Modeling and Simulation International *May 2020 - Present*

Reviewer

Multibody System Dynamics Journal, SAE technical papers

GSU Representative of The Association of Mechanical and Industrial Engineering Graduate Students *Toronto, Canada*

Mechanical and Industrial Engineering Department, University of Toronto *June 2013 - June 2014*

Editor in Chief *Tehran, Iran*

Namehmech Magazine *Sep. 2009 - Sep. 2010*

HR Manager *Tehran, Iran*

Namehmech Magazine *Sep. 2008 - Sep. 2009*

Skills

Programming Python, C/C++, LaTeX, PyTorch, TensorFlow, DGL

CAE Software Ansys, Autodesk Nastran, HyperWorks, SolidWorks, Inventor, AutoCAD

Languages English, Farsi