Siril Dukkipati

sirilteja.dukkipati@ 📧 | siril.dukkipati@ 🛡 | +1-(438)-3456704 | 🔗 /Siril-TD | 🌐 www.siril.me

EDUCATION

McGill University   Montreal, CA

Ph.D. in Mechanical Engineering   *Jan. 2022 – Present*

Master of Science in Mechanical Engineering; Fast-track; **CGPA: 4.0/4.0**   *Sep. 2020 – Dec. 2021*
  - *Research Interests:* Biomechanics, System Modeling, Mechanical Design
  - *Thesis:* Biomechanical design and validation of a benchtop robotic spine with applications in chronic low back pain research

Manipal University   Manipal, IN

Bachelor of Technology in Mechanical Engineering; **CGPA: 9.17/10.0**   *Aug. 2016 – May 2020*
  - *Specialization:* Mechanical Design
  - *Thesis:* 3D-Printing of Self-Healing Soft Robots *at Vrije Universiteit Brussel, Belgium.*

EXPERIENCE

Musculoskeletal Biomechanics Research Lab, McGill Univesity 🔗   Montreal, CA

Ph.D. Candidate   *Sep. 2020 – Present*
  - **3D Printable Spine Phantoms**: Developed and open-sourced the first-ever fully 3D printable lumbar spine biomechanical phantom in literature, currently being used by an industry partner to validate their technology.
  - **Hi-Fi Digital Twins**: Developed and validated fast-solving models of the human torso including the spine, the pelvis, the abdominal cavity, the ribcage and various muscle groups. These models are then used to train RL agents to predict muscle recruitment patterns under various loading scenarios.
  - **Robotic Spine**: Developed a benchtop robotic spine model with focus on replicating human-like torso and spine kinematics and kinetics. Also developed the control logic and a GUI to manipulate the robot. Experienced in MATLAB, LABVIEW, sensors integration, real-time testing and tuning.

SURE Award Research Assistant   *May 2019 - Aug 2019*
  - Pneumatic Artificial Muscle modeling and integration on the robotic spine with muscle pressure control in MATLAB and LABVIEW for stabilization

Department of Mechanical Engineering, McGill University 🔗   Montreal, CA

Course Lecturer - MECH 561: Biomechanics of Musculoskeletal Systems - 3 credits   *Jan 2024 – present*

Teaching Assistant - MECH 262, 290, 360, BIEN 500   *Sept 2020 – Present*

Vice President of Academics, Graduate Student Association (GAMES)   *June 2022 - June 2023*

SimCare   Montreal, CA

Biomedical Engineer (part-time)   *Aug. 2024 – present*
  - Design and develop custom biomechanical phantoms replicating human anatomy as part of a lab spinoff. Collaborate with industry partners to deliver patient-specific, spine-related solutions tailored to their needs.

Foodlabs Inc. [stealth]   Bangalore, IN

Chief Technical Officer, Mechanical Engineer   *Jul. 2020 – Sep. 2024*
  - Led a team of engineers to develop a software platform for user-centric food order customization. Designed robotic systems and a hardware ecosystem for "automated kitchen" deployment.

R&MM Research Group, Vrije Universiteit Brussel 🔗   Brussels, BE

Research Assistant   *Dec 2019 – Apr 2020*
  - Designed and prototyped a custom print head for 3D printing temperature-sensitive polymers, enabling the development of self-healing soft robotic grippers, including a hybrid gripper capable of withstanding cuts from sharp payloads like knives.

Projects

SpineSim Validation | *MDsim* ⬀   *Aug 2024 – Present*
- Built patient-specific spine biomechanical phantoms and analyzed its performance pre- and post- L3-L4 spinal fusion surgery.
- Generate validation data for SpineSim, a digital twin platform with applications in spinal surgery planning.

International Spine Biomechanics Consortium | *Sawbones Inc.* ⬀   *Jan 2022 – Present*
- Formed an international consortium of biomechanics labs focused on spine testing, performing multi-lab, multi-protocol testing on spine surrogates to establish a standard in spine testing.
- Collaborated with 7 participating labs and presented the results at international conferences like ORS and ISTA.

McGill - Wake Forest Collaboration | *Brown Lab* ⬀   *Oct 2023 – Present*
- Formed a collaboration with Dr. Philip Brown and Emma Coltoff at Wakeforest University to perform full-field, multi-specimen, multi-lab, multi-protocol spine surrogate testing.
- The research provides an understanding of the biomechanics of spine phantoms under multi-planar loading scenarios commonly seen in daily activities.
- Partly funded by the **ORS 2024 Travel Grant**.

Mars Rover Manipal ⬀   *Dec 2016 – May 2019*
- Led a team of 4 as Research Lead (2019) on robotic exploration projects, including an autonomous bicycle and underactuated robotic gripper.
- Developed a Mars Rover prototype with autonomous navigation, equipment servicing, and astronaut assistance capabilities.
- Ranked 1st place globally at the Indian Rover Challenge (IRC 2017) and 7th place worldwide at the University Rover Challenge (URC 2018, Utah, USA).

Crawler Bot | *Perma-Liner* ⬀   *May 2019 – Aug 2019*
- Led a team of 12 to develop a crawler bot for pipeline exploration and repair, featuring a novel snake-inspired drive system for navigating tight bends.

Awards & Achievements

Total awards amounting to 160K+ USD

- GREAT Travel Award 2022, 24, McGill University, Montreal, CA.
- Fonds de recherche du Québec–Nature et Technologies (FRQ-NT) Doctoral Research Scholarship 2024, CA.
- Fonds de recherche du Québec–Nature et Technologies (FRQ-NT) Master's Research Scholarship 2022, CA.
- McGill Engineering Doctoral Award (MEDA) 2022, McGill University, Montreal, CA.
- Graduate Excellence Award 2020, 21, 22, 23, 24, McGill University, Montreal, CA.
- Best Paper Award - RIACT 2020 Conference, Vellore, IN.
- Rubin Gruber SURE Award 2019, McGill University, Montreal, CA.
- Manipal Scholar Award 2016 - 2020, Manipal University, IN.

Technical Skills

Languages: Matlab, LabVIEW, Python, C/C++, HTML
Design: Catia, SOLIDWORKS, AutoCAD, Fusion 360, nTopology
Analysis: Ansys Mechanical APDL & Workbench, Adams
CAM: Fusion 360 Machining, MasterCAM; Cura, Prusa & FormLabs printers for 3D Printing

Publications ⬀

Journal articles

[3] **Dukkipati, S.**, Driscoll, M., Evaluation of a High Fidelity Rigid Body Spine Model for Muscle Recruitment and Intra-Abdominal Pressure Simulations. (under review)

[2] **Dukkipati, S.**, Driscoll, M., Development and Biomechanical Evaluation of a 3D Printed Analogue Lumbar Spine Motion Segment. doi: 10.2139/ssrn.4154354 (under review)

[1] Dukkipati, S., Driscoll, M., (2024) Design Improvements and Validation of a Novel Fully 3D Printed Analogue Lumbar Spine Motion Segment. *Journal of Bionic Engineering* 21, 1388–1396. doi: 10.1007/s42235-024-00512-8

Podium Talks

[13] Coltoff, E.C., **Dukkipati, S.**, Driscoll, M., Brown, P.H., (2025) Full-Field Biomechanical Testing of Spinal Surrogates: An Inter-laboratory comparative Study Towards Standardized Spine Testing, Orthopaedic Research Society (ORS) 2025 Annual Meeting, Phoenix, Arizona, USA. *(upcoming)*

[12] Dukkipati, S., Driscoll, M., et. al. (2025) Development and Validation of a High Fidelity Rigid Body Dynamic Spine Model Inclusive of Intra-abdominal Pressure, IMAC-XLIII, Society of Experimental Mechanics, Orlando, Florida, USA. *(upcoming)*

[11] Dukkipati, S., Driscoll, M., et. al. (2024) Novel Benchtop and In silico Alternatives to Traditional Spine Biomechanics Research Methodologies, 10th International Conference on Mechanics and Materials in Design (M2D 2024), Nagoya, Japan. Abs

[10] Dukkipati, S., Driscoll, M., et. al. (2024) A Systematic Benchtop Construction and Deconstruction Study of Spinal Ligaments Using Novel 3D Printable Analogue Spine Models, International Society for Technology in Arthroplasty (ISTA), Nashville, Tennessee, USA. Abs ***GREAT Award***

[9] Wahbeh, J., Loss, J.G., Coltoff, E.C., **Dukkipati, S.**, Chastain, K., Pelletier, M., Wang, T., Brown P.J., Driscoll M., Sangiorgio S.N., Ebramzadeh E., Meyers K., Walsh W., Cornwall B., Kelly B., Colbrunn R., (2024) Composite Lumbar Spine Surrogate Biomechanical Variability During Multi-Laboratory Collaborative Testing, International Society for Technology in Arthroplasty (ISTA), Nashville, Tennessee, USA. Abs

[8] Wahbeh, J., Loss, J.G., Coltoff, E.C., **Dukkipati, S.**, Chastain, K., Pelletier, M., Wang, T., Brown P.J., Driscoll M., Sangiorgio S.N., Ebramzadeh E., Meyers K., Walsh W., Cornwall B., Kelly B., Colbrunn R., (2024) Temporal Variation in Artificial Composite Spinal Surrogates Through Inter-Laboratory Spine Biomechanics Testing, International Society for Technology in Arthroplasty (ISTA), Nashville, Tennessee, USA. Abs

[7] Dukkipati, S., Driscoll, M., (2024) Quantifying the effect of ligament tears on lumbar spine stiffness: A systematic construction and deconstruction study using novel 3D printable analogue spine models, EUROSPINE Annual Meeting, Vienna, Austria. doi: 10.1016/j.bas.2024.103287

[6] Dukkipati, S., Driscoll, M., (2024) 3D Printable Analogue Spine Models: Towards Cost and Time Effective Spinal Biomechanical Research, IMAC-XLII, Society of Experimental Mechanics, Orlando, Florida, USA. doi: 10.1007/978-3-031-68901-7_3

[5] Dukkipati, S., Driscoll, M., (2024) Effect of Ligaments on Lumbar Spinal Stiffness: A Systematic Investigation Using Novel 3D-Printed Analogue Spine Models, IMAC-XLII, Society of Experimental Mechanics, Orlando, Florida, USA. doi: 10.1007/978-3-031-68901-7_12

[4] Dukkipati, S., Driscoll, M., (2023) Analogue models of the Thoracolumbar Fascia, Summer school on Fascial Anatomy, Montreal, Canada.

[3] Dukkipati, S., Driscoll, M., (2022) Viscoelastic Properties of a 3D Printed Analogue of Thoracolumbar Fascia, 6th International Fascia Research Congress, Montreal, Canada. Abs

[2] Dukkipati, S., Driscoll, M., (2022) Design and validation of 3D printed analogous lumbar model for use in a robotic benchtop spine model, 11th European Solid Mechanics Conference, Galway, Ireland. Abs ***GREAT Award***

[1] Dukkipati S. et al., (2018) Design and analysis of underactuated gripper using Chebyshev lambda mechanism with slip preventive strategy for fragile objects, Second International Conference on Advancements in Automation, Robotics and Sensing (ICAARS) 2018, Coimbatore, India. Abs

Posters

[17] Dukkipati, S., Driscoll, M., (2025) Validation of a Fast-Solving Rigid-Flexible Body Dynamic Model of the Spine for Use in Muscle Recruitment Optimization Problems, 25rd Annual Scientific Conference of The Canadian Spine Society, Charlevoix, Quebec, Canada. *(upcoming)*

[16] **Dukkipati, S.**, Driscoll, M., (2025) Development of a Novel Rigid-Flexible Body Dynamic Model as a High-Fidelity Parametric Biomechanical Digital Twin of the Human Torso, 25rd Annual Scientific Conference of The Canadian Spine Society, Charlevoix, Quebec, Canada. *(upcoming)*

[15] **Dukkipati, S.**, Driscoll, M., (2025) Evaluation of an intra-abdominal pressure inclusive rigid body dynamic torso model for fast-solving high-fidelity simulations, Global Spine Congress 2025, Rio de Janeiro, Brazil. *(upcoming)*

[14] **Dukkipati, S.**, Driscoll, M., (2025) Development And Validation Of A High Fidelity Rigid Body Spine Model Inclusive Of Intra-abdominal Pressure, Orthopaedic Research Society (ORS) 2025 Annual Meeting, Phoenix, Arizona, USA. *(upcoming)*

[13] **Dukkipati, S.**, Driscoll, M., (2025) Biomechanical Evaluation Of Fully 3D Printable L1-S1 And L2-L5 Spine Surrogates In Pure Moment Loading, Orthopaedic Research Society (ORS) 2025 Annual Meeting, Phoenix, Arizona, USA. *(upcoming)*

[12] Coltoff, E.C., Loss, J.G., **Dukkipati, S.**, Driscoll, M., et al. (2024) Biomechanical Variability in Composite Lumbar Spine Surrogates During Multi-Laboratory Collaborative Testing, Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Lake Geneva, Wisconsin, USA. Paper No. 400

[11] Coltoff, E.C., Loss, J.G., **Dukkipati, S.**, Driscoll, M., et al. (2024) Temporal Variability in Composite Lumbar Spine Surrogates During Multi-Laboratory Collaborative Testing, Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C), Lake Geneva, Wisconsin, USA. Paper No. 410

[10] **Dukkipati, S.**, Driscoll, M., (2024) Ligament damage models in the lumbar spine: Modeling using a novel 3D printable analogue model, 24rd Annual Scientific Conference of The Canadian Spine Society, Whistler, British Columbia, Canada. doi: 10.1503/cjs.011424

[9] Coltoff, E.C., Loss, J.G., **Dukkipati, S.**, Driscoll, M., et. al. (2024) Composite Lumbar Spine Surrogate Biomechanical Variability During Multi-Laboratory Collaborative Testing, Orthopaedic Research Society (ORS) 2024 Annual Meeting, Long Beach, California, USA. Paper No. 2230

[8] Coltoff, E.C., Loss, J.G., **Dukkipati, S.**, Driscoll, M., et. al. (2024) Temporal Variation in Artificial Composite Spinal Surrogates through Inter-laboratory Spine Biomechanics Testing, Orthopaedic Research Society (ORS) 2024 Annual Meeting, Long Beach, California, USA. Paper No. 2228

[7] **Dukkipati, S.**, Driscoll, M., (2023) Rotational stiffness in a fully 3D printed biomechanical analogue of the lumbar spine, Global Spine Congress 2023, Prague, Czech Republic. doi: 10.1177/21925682231166109

[6] **Dukkipati, S.**, Driscoll, M., (2023) Effect of ligaments on spinal stiffness by systematic construction of an L1-S1 analogue spine model, Global Spine Congress 2023, Prague, Czech Republic. doi: 10.1177/21925682231166109

[5] **Dukkipati, S.**, Driscoll, M., (2023) On the effect of thoracolumbar fascia on lumbar spine stiffness under loading in an analogue spine setup, Global Spine Congress 2023, Prague, Czech Republic. doi: 10.1177/21925682231166109

[4] **Dukkipati, S.**, Driscoll, M., (2023) Pure bending stiffness in a fully 3D printed L1-S1 lumbar spine model, 4th International workshop on spinal loading and deformation, Berlin, Germany. Poster P7

[3] **Dukkipati S.**, (2020) A hybrid soft gripper with self-healing capability, Robotics, Intelligent Automation and Control Technologies (RIACT) 2020, Vellore, India. ***Best Paper Award***

[2] **Dukkipati S.**, (2020) Self-Healing Soft Robotics: Design & Prototyping of a Self-Healing Soft Gripper, Thesis work for Bachelors degree in Mechanical Engineering at Manipal Institute of Technology, India.

[1] **Dukkipati, S.**, Driscoll, M. (2019) Implementation of the control system on a robotic spine & Validation of the benchtop model, SURE 2019, McGill University, Canada.