

Kavindu Wijesinghe

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TECHNICAL SKILLS

- Material Characterization: Expertise in metallic sample preparation including mechanical/electro-chemical polishing & etching, Scanning Electron Microscopy (SEM), Optical Microscopy, Atomic Force Microscopy (AFM), X-ray Diffraction (XRD), Electron Backscatter Diffraction (EBSD), Energy Dispersive Spectroscopy (EDS), in-situ/ex-situ tensile testing (room/high temperature), nanoindentation, Digital Image Correlation (DIC), metal heat treatment, residual stress measurement, hazardous chemical handling with strong laboratory management skills.
- Product Design & Manufacturing: 2D/3D modeling/drawing, animation, Finite Element Analysis (FEA) & Computational Fluid Dynamics (CFD), additive manufacturing including selective laser melting of stainless steel & Fused deposition modeling of polymers), manual & Computer Numerical Control (CNC) machining/programming, welding, etc.
- Deep Learning & Image Processing: Advanced experience in deep learning and computer vision for material analysis. Skilled in Python, C++ and MATLAB for algorithm development and computational tasks.
- Robotics and Automation: Expertise in robotics and automation using Arduino, ESP32, Raspberry Pi, and PLCs.
- Computer Software: SolidWorks, CREO, Ansys, Aztec Crystal, MATLAB MTEX tool, Ncorr, Siemens NS, 3DS Max, etc.

PROFESSIONAL EXPERIENCE

Research Assistant

Clarkson University, Potsdam, NY, USA

January 2020 - April 2025

- Investigating Deformation Mechanisms of Additively Manufactured Alloys: Conducted comprehensive material characterization of anisotropic Directed Energy Deposited (DED) Ti-6Al-4V. Performed in-situ SEM micro-tensile testing to uncover microscopic deformation mechanisms and introduced the intergranular compatibility deformation theory, explaining strength anisotropy and enhancing the understanding of additively manufactured titanium alloys.
- Optimizing Alloy Composition for Superior Mechanical Properties: Designed and fabricated Ti-6Al-4V blocks with varied hypo-eutectic Boron concentrations (0.0 - 1.5 wt.%) using DED. Uncovered non-monotonic tensile behavior through extensive uniaxial tensile testing and identified an optimal Boron concentration (0.05 wt.%) for isotropic tensile properties. This work revealed underlying principles providing valuable insights for material design.
- Innovating Automated Testing Systems (Patent Pending): Designed and built a fully automated in-situ tensile testing system integrating a 3-axis motorized stage, high-resolution microscope camera and a 1000lb micro-tensile tester. The system, positioned above an inverted optical microscope, captures high-resolution deformation images at magnifications of 5X, 10X, and 20X in under 8.5 minutes. Developed automation software in C++ (Arduino) and Python for feature tracking, autofocus, panoramic imaging, and post-processing (e.g., focus stacking and stabilization). This innovation streamlines real-time mechanical testing and material analysis.
- Pioneering AI-Driven Strain Measurement: Developed a deep learning framework to measure local strain by segmenting and tracking microstructural features in extensive in-situ micro-tensile video datasets. This approach enables precise strain mapping and deformation analysis for advanced material studies.
- Developing a Virtual In-Situ Testing Framework (Ongoing): Creating a generative AI framework using latent diffusion modeling to predict microstructural deformation in solution-annealed stainless steel 316L. This innovation aims to predict material behavior up to 20% macroscopic strain, reducing experimental costs and time for industrial testing.
- Mentoring Emerging Researchers: Supervised and mentored seven undergraduate summer research students, providing hands-on training in sample preparation, mechanical testing, heat treatments, and data analysis. Guided students in presenting their findings at Clarkson's RAPS showcase, fostering the next generation of materials scientists.

Mechanical Engineer

AHEAD UAV Laboratory (Startup Company) - Colombo, Sri Lanka

January 2019 - December 2019

- Quadcopter Development for Aerial Mapping (original design): Designed and fabricated a prototype quadcopter, Mora-X, optimized for aerial mapping with superior aerodynamics and weight distribution. Integrated advanced design and fabrication techniques, laying the foundation for future product commercialization in the UAV industry.

Self-Employee & Freelancer

3DMart 3D printing service & Freelancer at Fiverr - Colombo, Sri Lanka

April 2018 - December 2019

- Custom 3D Printing & Engineering Services: Provided personalized 3D modeling and printing solutions using a Creality Ender 3 PLA printer. Delivered high-quality designs tailored to customer specifications, supporting a wide range of applications. Offered professional engineering services, including FEA and CFD. Built a trusted business, delivering high-value mechanical engineering solutions and fostering customer satisfaction.

Mechanical Engineering Intern

Camso Loadstar Pvt. Ltd. – R&D Facility of Wheel Manufacturing Division, Ekala, Sri Lanka

June 2017 - December 2017

- Automating Quality Control Processes: Designed a fully automated tire runout checking device using pneumatic actuation to streamline quality control in the Tire Assembly Facility. The device ensured real-time inspection within the production line, reducing operational downtime and increasing output consistency.

EDUCATION

Ph.D. in Materials Science and Engineering

Clarkson University, Potsdam, NY | GPA: 3.795/4.00

December 2022 - April 2025

Master of Science in Mechanical Engineering

Clarkson University, Potsdam, NY | GPA: 3.83/4.00

January 2020 - December 2022

(Clarkson Ignite Presidential Scholarship Receiver: 2020 - Fall)

B.Sc. in Mechanical Engineering

University of Moratuwa, Colombo, Sri Lanka | GPA: 3.49/4.2

August 2014 - December 2018

(Dean's List for Academic Excellence: 2017)

JOURNAL PUBLICATIONS & PATENTS

- **Wijesinghe K.**, Herath C., Michopoulos J.G., Arnold S.M. and Achuthan A., 2024. Hierarchical Anisotropic Material Response of Directed Energy Deposited (DED) Ti-6Al-4V alloy. *Acta Materialia*, p.120080.
- **Wijesinghe K.**, Wannan J., Banerjee N.K., Banerjee S. and Achuthan A., 2021. Characterization of microscopic deformation of materials using deep learning algorithms. *Materials & Design*, 208, p.109926.
- Wannan J., **Wijesinghe K.** and Achuthan A., 2023. Columnar grain morphology and mechanical anisotropy of face-centered cubic metals and alloys. *Scripta Materialia*, 236, p.115684.
- **Wijesinghe K.**, B. Dayner, J. G. Michopoulos, S. M. Arnold, A. Achuthan "Boron Addition for Enhanced Mechanical Properties in Directed Energy Deposited Ti-6Al-4V: Underlying Mechanisms" (*Submitted to MSEA*).
- Herath C., **Wijesinghe K.**, Michopoulos J.G., Arnold S.M. and Achuthan A., 2024. Hierarchical Deformation and Anisotropic Behavior of ($\alpha + \beta$) Ti Alloys: A Microstructure-Informed Multiscale Constitutive Model Study. *International Journal of Plasticity*, p.104163.
- **Wijesinghe K.**, Ashwin A., Wannan J., S. M. Arnold, A. Achuthan "Physics-Informed Generative AI for Predicting Material Deformation: Latent Diffusion Modeling from Undeformed Microstructures" (*Under Preparation*).
- Jayawardane H., **Wijesinghe K.**, Wildeniya P. and Gamage J.R., "Design of a sustainable automotive turbocharger remanufacturing system". In *2020 Moratuwa Engineering Research Conference (MERCon)* (pp. 608-613). IEEE.
- Achuthan A., Banerjee N.K., Banerjee S., Wannan J. and **Wijesinghe K.** Invention title: Methods and apparatus for a mechanical testing system to characterize the heterogeneous deformation at microscale. *Application No: 63344918*.

CONFERENCE TALKS

- **Wijesinghe K.**, Wannan J., Banerjee N.K., Banerjee S. and Achuthan A., "Characterization of microscopic deformation of materials using deep learning algorithms". *MS&T Conference, Columbus, OH, 2021 October*.
- **Wijesinghe K.**, Wannan J., Banerjee N.K., Banerjee S. and Achuthan A., "Characterization of microscopic deformation of materials using deep learning methods". *Solid Freeform Fabrication Symposium, Austin, TX, 2022 July*.
- **Wijesinghe K.**, Wannan J., Banerjee N.K., Banerjee S. and Achuthan A., "Characterization of microscopic deformation of materials using computer vision". *AIAA SciTech Forum, National Harbor, MD, 2023 January*.
- **Wijesinghe K.**, Herath C., Michopoulos J.G., Arnold S.M. and Achuthan A., 2024. On Enhancing the Mechanical Properties of DED Fabricated Ti-6Al-4V by Boron Addition and In-situ Reheating. *TMS 2023, San Diego, CA, March 2023*.
- **Wijesinghe K.**, Herath C., Michopoulos J.G., Arnold S.M. and Achuthan A., 2024. Experimental Analysis of Various Microscopic Deformation Mechanisms of Directed Energy Deposited Ti-6Al-4V. *TMS 2024, Orlando, FL, March 2024*.