

Dr. Vedang Chauhan, P.Eng.

Assistant Professor

Department of Mechanical Engineering
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Nationality: Canadian Citizen

Google scholar Profile: <https://scholar.google.com/citations?hl=en&user=1KIQS1EAAAAJ>

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EDUCATION

2013-2016

Doctor of Philosophy

Mechanical and Materials Engineering Department, **Queen's University, Canada.**

Thesis: Fault detection and classification in automated assembly machines using machine vision.

Supervisor: Dr. Brian W. Surgenor, Professor, MME Department.

2004-2007

Master of Engineering (Research-based), specialization: Machine Design

Mechanical Engineering Department, **Sardar Patel University, India.**

Thesis: Application of fuzzy logic for determination of isomorphism, inversion and mobility in kinematic chains.

Supervisor: Dr. Anurag Verma, Professor, ME Department.

1999-2003

Bachelor of Engineering

Mechatronics Engineering Department, **Sardar Patel University, India.**

HONOURS AND AWARDS

2020 Fanuc Robot Programming Certification for Certified Instructor

2020 2020 Teaching Excellence Award Nominee at Western New England University

2014 R. Samuel McLaughlin Fellowship (doctoral level), Canada.

2013 Queen Elizabeth II Graduate Scholarship in Science and Technology, Canada.

GRANT PROPOSALS

2021 NSF Major Research Instrumentation Grant (applied)

2020 NSF Major Research Instrumentation Grant (applied and rejected)

2020 Department of Energy (DOE) funding, USA

2020 Massachusetts Clean Energy Center (MassCEC), USA

2019&2020 Toyota Research Institute North America (TRINA) grant, USA

2019 Western New England University Internal Grant for Fanuc Robot, MA, USA

2018 & 2019 MA Acorn Innovation Grant from Massachusetts Technology Transfer Center

2016-2017 Helped supervisor in writing NSERC grant proposal and successfully received it.

2013-2016 Helped in writing 4 Mitacs Accelerate grant proposals and successfully received.

REVIEWER

- Journal of Robotics, MDPI
- Journal of Machine Vision and Applications, Springer
- Journal of Applied Science, MDPI
- Sensors Journal, MDPI
- Journal of AriEngineering, MDPI
- Journal of Information, MDPI
- Waste Management Journal, Elsevier
- Electronics Journal, MDPI
- Engineering Applications of Neural Network (EANN) 2019 Conference, Greece
- Physica E: Elsevier Journal
- IEEE Advanced Intelligent Mechatronics (AIM) Conference, Banff, Alberta, Canada (2016)
- Innovations in Mechatronics Engineering (IME 09), Gujarat, India.
- North American Manufacturing Research Conference (NAMRC 43), NC, USA.

RESEARCH INTERESTS and PROJECTS

- Robot, Vision and Artificial Intelligence integration applied to manufacturing processes and products. Currently researching on 2D Vision Guided Fanuc LR Mate 200 iD robot system.
- Development of embedded controller-based mechatronics systems for industrial automation.
- Development and control of autonomous mobile robotic vehicles.
- 3D Vision guided Industrial robotics. Applied for NSF Funding.
- Machine Vision and Machine Learning based Liquid Water Distribution & Pressure Characterization in an Ex-Situ PEM Fuel Cell Channel, Toyota North America Funded Project, 2019-2021
- Machine Learning Accelerated Process Development for Scalable Manufacturing of Silica-based Glass Encapsulated Phase Change Materials Using Flow Mold Casting, DOE Funded Project, 2020-2022.

INDUSTRY RESEARCH EXPERIENCE

November 2017- July 2018

Computer Vision Engineer

Bluewrist Inc.- Robotics and Vision Company, Markham, Ontario

Research and development activities

- Managed the research and development of new products and processes including mathematical models, vision algorithms and robotic systems.
- Researched and evaluated new product concepts for technical and cost feasibility.
- Prepared technical reports and white papers.
- Developed and maintained image processing models and algorithms.
- Designed, deployed and maintained standalone industrial machine vision systems.

Dec. 2003- July 2004

Graduate Apprentice

Design Department, Elecon Engineering Company Ltd., India (<http://elecon.com/>).

Activities

- Designed conveyor pulleys for mining and steel industries for material handling as per customers' requirements.
- Prepared parts and assembly drawings for mechanical systems using AutoCAD and SolidWorks.
- Created installation, operation and maintenance manuals and technical specifications.

ACADEMIC RESEARCH AND TEACHING EXPERIENCE

August 2018- Present

Assistant Professor

Department of Mechanical Engineering, Western New England University, MA, USA.

Research activities

Project management, supervision and evaluation of UG and Graduate research projects:

- Design, development and optimization of an E-CVT system for small engines. Received funding from Massachusetts Technology Transfer Center for 2018, 2019.
- Fanuc robot programming projects.
- PLC controlled automation system.
- AI-based machine vision inspection system for parts classification and sorting.
- IoT-based tank water liquid level control.
- Arduino controlled 5-axis robot.
- Mobile robots for ASME Student Design Competition.

Collaborative externally funded research

- Machine Vision and Machine Learning based Liquid Water Distribution & Pressure Characterization in an Ex-Situ PEM Fuel Cell Channel, Toyota North America Funded Project, 2019-2021.
- Machine Learning Accelerated Process Development for Scalable Manufacturing of Silica-based Glass, DOE Funded Project, 2020-2022.
- 2D vision guided Fanuc robotics system in collaboration with Central Connecticut State University, CT, USA.

Teaching activities

- Courses teach:
 - ME 656 Advanced Mechatronics systems (graduate level course)
 - ME 480 Internship in Mechanical Engineering (4th level UG course)
 - ME 455 Applied Mechatronics systems (4th level UG course)
 - ME 437 Design Elective (4th level UG course)
 - ME 440 Senior Design Projects (4th level UG course)
 - ME 427 Kinematics and Control (4th level UG course)
 - ME 203 Dynamics (2nd level UG course)
 - ME 202 Engineering Statics (2nd level UG course)
- Design course policies and syllabus. Implement project-based learning to encourage curiosity, connections and create value in learning.

- Update lecture notes, additional reading material, exercises, homeworks, online quizzes, assignments on the Desire2Learn (D2L) Brightspace Learning Environment called Kodiak.
- Conduct theory classes using various teaching aids such as board work, presentations, animations, simulations, videos and e-learning systems.
- Prepare, administer and grade examinations, laboratory assignments and reports to evaluate students' progress.
- Help students with special needs.
- As a student adviser of 36 students, advise students on program curricula and career decisions.
- Supervise students' research projects.
- Attend professional development workshops on and off campus.

Services

- President Vision 2025 advisory committee member
- Baja club Adviser.
- ASME Design Competition Adviser.
- ME Curriculum Committee member
- ME Department representative for President's Committees
- Helped in organizing First robotics competition at WNEU.
- Committee member of home coming, open houses and engineering fairs committees.
- Departmental search committee member.

September 2017- December 2017 (part-time)

Course Instructor

School of Skilled Trades, St. Lawrence College, Kingston, ON

Teaching Activities

- Uploaded course material, quizzes, homeworks on **Blackboard** e-learning system.
- Conducted theory classes and laboratory sessions for the following skilled trades courses in Mechanical Technician and Industrial Mechanical (Millwrights) programs:
 - MECT 403: CAD | MECT 103: Technical Drawing | MILL 309: Fluid Power
- Performed administrative duties. Graded students' exams and reports.

July 2016- October 2017

Research Assistant

Mechanical and Materials Engineering Department, Queen's University.

Research activities

- Designed, developed and implemented MATLAB Simulink-based lab experiments for MECH 350: Automatic Controls course.
- Prepared lab handouts and learning material for the course.

July 2016- June 2017

Postdoctoral Fellow

Mechanical and Materials Engineering Department, Queen's University.

Research activities

- Project 1: An advanced machine learning based machine vision system for the recognition of Indian coins, part II (funded by Mitacs Accelerate).
- Project 2: Low Cost Power Monitoring for an autonomous robotic vehicle.
- Project 3: DC Motor control using Simulink.
- Project 4: Design and implementation of an emergency stop mechanism (closed loop control) for an automated assembly machine.

Technical Advisor for the following undergraduate and graduate research projects:

- Project 5: Undergraduate Research Project (MECH 461): Optical sensor for proximity detection.
- Project 6: Undergraduate Research Project (MECH 461): Sensing of colour under variable lighting condition.
- Project 7: Undergraduate Research Project (MECH 461): Accelerometer and gyroscope sensing of impact, orientation and velocity.
- Project 8: M.Eng. Research Project: Machine vision based automated inspection and sorting system.
- Project 9: Ph.D. Research Project: Machine learning based flexible machine vision inspection system.

- Planned and Managed research projects.
- Designed, developed, prototyped and troubleshot machine vision and mechatronics systems as per customers' requirements.
- Developed custom mechatronics applications for sorting small parts and classification of coins using NVIDIA's Deep Learning GPU Programming.
- For experimental testing, interfaced sensors and actuators, acquired and processed the data and evaluated the system performance by analysing the results.
- Mentored 5 design projects mechanical engineering students and provided them technical advice and support.

September 2016- December 2016

Adjunct Assistant Professor

Mechanical and Materials Engineering Department, Queen's University.

Teaching activities

- Course taught: MECH 452 Mechatronics Engineering (4th level undergraduate)
- Conducted presentations using videos, software simulations and demonstrations for a class of 24 students.
- Setup a laboratory with the required hardware and software prior to each session.
- Supervised laboratory sessions and grade students' lab reports.

- Provided constructive feedback to students for their performance improvement.

Jan. 2013- June 2016

Research Assistant and Teaching Assistant

Mechanical and Materials Engineering Department, Queen's University.

Research activities

- Project 1: Fault detection and classification in automated assembly machines using machine vision.
- Project 2: An advanced machine vision-based system for the recognition of Indian coins, part I (funded by Mitacs accelerate).

Technical Advisor for the following undergraduate and graduate research projects:

- Project 3: MECH 460 Team Project: Design of an LED feeder for a Samsung SM482 assembly machine.
- Project 4: MECH 461 Research Project: Investigation of low cost sensors for autonomous mobile robots.

- Researched and developed machine vision and mechatronics systems for inspection of industrial automated machines and mobile robots.
- Developed and maintained a smart camera-based standalone machine vision inspection system for geometric measurement of metal and plastic parts.
- Design experimental setup and conducted experiments for the research projects.
- Compiled and analyzed research results for submission to journal articles and conference papers.
- Mentored research projects of undergraduate and graduate mechanical engineering students.

Teaching activities

- Conducted weekly laboratory sessions for a class of 24 students and graded reports for the following courses.
 - MECH 452 Mechatronics Engineering (4th level)
 - MECH 350 Automatic Controls (3rd level)

July 2005 – Dec. 2012

Assistant Professor (July 2011 – Dec. 2012)

Lecturer (July 2005-Apr. 2011)

Mechatronics Engineering Department, Sardar Patel University, G. H. Patel College of Engineering and Technology, India (www.gcet.ac.in).

Research Activities

- Supervised UG and graduate students' projects in the area of mechatronics, automation and machine vision.
- Performed project management activities such as weekly meetings, feedback and evaluations.

- Provided feedback on technical reports and presentations and evaluated the performance.

Teaching activities

- Courses taught at undergraduate level:
Automated Manufacturing (4th level) | Robotics and Control Systems (4th level) | Machine Vision (4th level) | Electro-Mechanical Measurement and Instrumentation (3rd level) | Programmable Logic Controller (PLC) (4th level) | Computer Aided Design (CAD) (3rd level) | Hydraulic and Pneumatic Systems (3rd level) | Engineering Design (2nd level) | Basic Mechanical Engineering (1st level).
- Designed course curriculum and outlines for the above-mentioned courses.
- Delivered lectures using various teaching aids such as board work, power point presentations, computer simulations, physical models, demonstrations, 2D/3D animations and short videos for a class of 60 to 80 students.
- Prepared, administered and graded examinations, laboratory assignments and reports to evaluate students' progress.
- Helped students with special needs.
- As a student counsellor, advised students on program curricula and career decisions.
- Supervised undergraduate students' research projects.

Services

- In-Charge of Mechatronics, fluid power and Automation laboratory
- Conducted open houses and organized field trips
- As a Team Member of Industrial Consultancy Group, organized and conducted professional training programs on Computer Aided Manufacturing (CAM) and Hydraulic Systems, CNC Programming and PLC Programming for industry personnel.
- Organized a national conference – Innovations in Mechatronics Engineering (IME), 2009.
- As a Team Member of Student Placement Group invited hiring committees of industries for on-campus interviews and developed industrial collaborations for research projects.

COMMUNITY EXPERIENCE

Spring 2019

Team member

First Robotics Competition organization committee, WNE.

Oct. 2013, 2014 and 2015

Representative

Graduate Studies, Engineering and Technology Fair, Queen's University.

Represented Engineering and Applied Science booth at Engineering and Technology Fair during 2013 to 2015. Provided visitors the information about the opportunities and benefits of graduate studies.

May 2014

Representative

Science Rendezvous, Kingston, ON.

Represented Faculty of Engineering and Applied Science (FEAS) booth at Science Rendezvous. Guided visitors through a simple hands-on design challenge. Answered their questions with simple explanation and examples.

Sept. 2013

Team member

Science, Technology, Engineering and Math (STEM) Program, Royal Military College.

Introduce engineering design process, followed by a design challenge competition to groups of Sea Cadets ranging from 25 to 90 (age group: youth). Contributed to lectures, hands-on portion of the design challenge and evaluation feedback during the sessions.

PUBLICATIONS

1. Santamaria, A. D., Mortazavi, M., Chauhan, V., Benner, J., Philbrick, O., Clemente, R., Jia, H., Ling, C.(2021). Machine Learning Applications of Two-Phase Flow Data in Polymer Electrolyte Fuel Cell Reactant Channels. *Journal of the Electrochemical Society*, 168, 054505.
2. Chauhan, V., Mortazavi, M., Benner, J., Santamaria, A. D. (2020). Two-Phase Flow Characterization in PEM Fuel Cells Using Artificial Neural Networks. *Energy Reports Journal*.
3. Santamaria, A. D., Mortazavi, M., Chauhan, V., Benner, J., Philbrick, O., Clemente, R., Jia, H. and Ling, C. (2020). Applications of Artificial Intelligence for Analysis of Two-Phase Flow in PEM Fuel Cell Flow Fields. *ECS Transactions*, Vol 98, No. 9.
4. Whinery, B., Gulak, Y., Chauhan, V., Zhao, J., Benner, J., Ye, F.(2020). Thermal Image Processing for Feature Extraction from Encapsulated Phase Change Materials. 13th International Conference on Machine Vision (ICMV 2020), Italy.
5. Zhang, M., Chauhan, V., Zhou, M.(2020). A Machine Vision Based Smart Conveyor System. 13th International Conference on Machine Vision (ICMV), Italy.
6. Mortazavi, M., Santamaria, A. D., Chauhan, V., Benner, J., Heidari, M., Médicci, E.(2020). Effect of PEM fuel cell porous media compression on in-plane transport phenomena. *Journal of Power Sources Advances*, Vol 1.
7. Stolberg, P., Coverdill, A., Mortazavi, M., Benner, J., Chauhan, V., Santamaria, A. D. (2019). Droplet Dynamics and Removal from Polymer Electrolyte Fuel Cell Channels Using Acoustic Pressure Waves. *ECS Transactions*. Vol 92, No. 8.
8. Chauhan V, D., Joshi, K, D. and Surgenor, B. W. (2019). Image Classification Using Deep Neural Networks: Transfer Learning and the Handling of Unknown Images. *Engineering Applications of Neural Networks*, Springer CCIS 1000, Chapter 23.
9. Mortazavi, M., Santamaria, A. D., Benner, J., Chauhan, V. (2019). Enhanced Water Removal from PEM Fuel Cells Using Acoustic Pressure Waves. *Journal of The Electrochemical Society*, 166 (7) F3143-F3153.

10. Mortazavi, M., Santamaria, A., Benner, J., Chauhan, V. (2019). Water removal from flow channels of PEM fuel cells by superimposing acoustic pressure waves on gas flow. The ASME 2019 17th International Conference on Nanochannels, Microchannels and Minichannels (ICNMM2019), Newfoundland, Canada.
11. Chauhan, V., Joshi, K. D., Surgenor, B. W. (2018). Wire connector classification with machine vision and a novel hybrid SVM. Tenth International Conference on Machine Vision (ICMV 2017), Vienna, Austria.
12. Barea G., Surgenor, B. W., Chauhan, V., Joshi, K. D. (2018). A low-cost machine vision system for the recognition and sorting of small parts. Tenth International Conference on Machine Vision (ICMV 2017), Vienna, Austria.
13. Joshi, K. D., Chauhan, V. and Surgenor, B. W. (2018). A flexible machine vision system for small part inspection based on a hybrid SVM/ANN approach. *Journal of Intelligent Manufacturing*, 1-23.
14. Chauhan, V., Joshi, K. D. and Surgenor, B. W. (2017). Machine Vision for Coin Recognition with ANNs: Effect of Training and Testing Parameters. *Communications in Computer and Information Science (CCIS)*, Springer, 744, 523-534.
15. Chauhan, V. and Surgenor, B. W. (2016). Fault detection and classification in automated assembly machines using machine vision. *The International Journal of Advanced Manufacturing Technology (IJAMT)*, 1-22.
16. Joshi, K. D., Chauhan, V. and Surgenor, B. W. (2016). Comparative analysis of methods for the recognition of Indian currency coins. The 23rd conference on Mechatronics and Machine Vision in Practice (M2VIP), China.
17. Chauhan, V. and Surgenor, B. W. (2016). Performance evaluation of machine vision inspection for fault detection in automated assembly machines. *Proc. of the IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM 2016)*, Banff, Canada.
18. Joshi, K. D., Chauhan, V. and Surgenor, B. W. (2016). Real time recognition and counting of Indian currency coins using machine vision. *Proc. of the Canadian Society for Mechanical Engineering (CSME) International Congress*, Kelowna, Canada.
19. Gor, M., Chauhan, V., Verma, A. (2016). Isomorphism Detection of 10-links Kinematic Chain Using Joint Connectivity Approach. *International Journal of Innovative Research in Science, Engineering and Technology*, Vol. 5, Issue 6.
20. Chauhan, V. and Surgenor, B. W. (2015). A comparative study of machine vision-based methods for fault detection in an automated assembly machine. *Procedia Manufacturing*, 1, 416-428.
21. Fernando, H., Chauhan, V. and Surgenor, B. W. (2014). Image-based versus signal-based sensors for machine fault detection and isolation. *Proc. of the 12th ASME Biennial Conference on Engineering Systems Design and Analysis (ESDA)*, Denmark.
22. Chauhan, V., Fernando, H. and Surgenor, B. W. (2014). Effect of illumination techniques on machine vision inspection for automated assembly machines. *Proc. of the Canadian Society for Mechanical Engineering (CSME) International Congress*, Toronto, Canada.

23. Chauhan, V., Sheth, S. and Hindocha, B., Shah, R., Dudhat, P. and Jani, P. (2011). Design and development of a machine vision system for part colour detection and sorting. Proc. of the Second International Conference on Signals, Systems and Automation (ICSSA-11), V.V. Nagar, India.
24. Soni, A., Aghera, M., Modi, C. and Chauhan, V. (2010). Machine vision based part inspection system using canny edge detection technique. Proc. of the Fourth International Conference on Advances in Mechanical Engineering (ICAME), Surat, India.
25. Patel, A., Chauhan, V. and Gelot, B. (2010). Modelling and analysis of two machine problem to generate the reachability tree using petri net system. Proc. of the Third International Conference on Advances in Mechanical Engineering, Surat, India.
26. Modi, C. and Chauhan, V. (2009). Machine vision based liquid level inspection system using Laplacian of gaussian edge detection technique. Proc. of the International Conference on Signals, Systems and Automation (ICSSA-09), V.V.Nagar, India.
27. Chauhan, V., Gelot, B. and Patel, A. (2009). Development of algorithm for watermarking of an image in spatial domain using random numbers and bit plane slicing method. Proc. of the National Conference on Innovations in Mechatronics Engineering (IME), V.V.Nagar, India.
28. Chauhan, V. and Verma, A. (2008). Application of fuzzy logic for determination of isomorphism among planner kinematic chain. Proc. of the National Conference on Emerging Trends in Mechanical Engineering, V.V.Nagar, India.

KEYNOTE ADDRESSES and PRESENTATIONS

- Nov 2020 “Thermal Image Processing for Feature Extraction from Encapsulated Phase Change Materials”, 13th International Conference on Machine Vision (ICMV 2020), Italy (online presentation), Nov 6, 2020 .
- Nov 2020 “A Machine Vision Based Smart Conveyor System”, 13th International Conference on Machine Vision (ICMV), Italy (online presentation), Nov 4, 2020 .
- Nov 2019 “Machine Vision and Machine Learning Applied to Automation”, Keynote address at TEQIP -III Sponsored First International Conference on Secure Reconfigurable Architectures and Intelligent Computing supported by IEEE at NIT Trichy, India.
- May 2019 “Image Classification Using Deep Neural Networks: Transfer Learning and the Handling of Unknown Images”, Engineering Applications of Neural Networks, EANN2019, Crete, Greece.
- Nov 2018 “Research trends in Mechatronics”, Industrial Engineering Department, WNEU.
- August 2017 “Machine Vision for Coin Recognition with ANNs: Effect of Training and Testing Parameters”. Paper presented at the Engineering Applications of Neural Networks (EANN) Conference, Athens, Greece.
- July 2016 “Performance Evaluation of Machine Vision Inspection for Fault Detection in Automated Assembly Machines”. Paper presented at the IEEE International Conference on Advanced Intelligent Mechatronics (AIM 2016), Banff, AB, Canada.

June 2015 “A Comparative Study of Machine Vision Based Methods for Fault Detection in an Automated Assembly Machine”. Paper presented at the 43rd North American Manufacturing Research Conference (NAMRC 43), Charlotte, North Carolina, USA.

SKILLS DEVELOPMENT PROGRAMS

Teaching Skills Development Programs

Fall 2020	Workshop	CTL workshops on e-learning at WNE
SP 2020	Conference	KEEN National Conference, Texas, USA
Fall 2018	Workshops	Various CTL workshops on understanding students' needs
Winter 2016	Course	SGS901: Teaching and Learning in Higher Education.
Sept. 2014	Workshop	Effective communication with your supervisor.
Sept. 2013	Workshop	Principles of teaching and learning.

Professional Skills Development Programs

July 2019	KEEN workshop	Fabrication workshop, Bucknell University, PA
Spring 2019	Workshops	CTL workshops at WNE
Nov. 2014	Workshop	Time management
Feb. 2014	Mitacs Step Program	Foundations of project management II.
Sept. 2013	Mitacs Step Program	Foundations of project management I.

Technical Skills Development Programs

Fall 2019	Training Program	Fanuc Robot Programming at Fanuc Academy
Spring 2019	Training Program	I-corps at UMass, Amherst
June 2012	Training Program	Computer aided design using Pro/Engineer (now Creo).
Jan. 2012	Training Program	LabVIEW graphical programming and data acquisition.
Feb. 2009	Workshop	Concurrent engineering for product design & development.
Feb. 2008	Training Program	Image processing: fundamentals and advances.
Dec. 2008	Training Program	Programmable Logic Controller (PLC).
June 2008	Workshop	Advances in CAM.
Nov. 2007	Training Program	SolidWorks 3D design and modelling.

Interpersonal Skills Development Programs

Fall 2018	Training Program	CTL, WNEU.
Jan. 2016	Course	Accessible instruction for educators.
July 2015	Training Program	Standard first aid-level A CPR.
Apr. 2015	Training Program	Accessible customer service.
Nov. 2013	Workshop	Intercultural competence certificate program.
May 2013	Training Program	WHMIS.

MEMBERSHIPS

2019-present	Member, American Society of Mechanical Engineers (ASME)
2019-present	Member, Society of Mechanical Engineers (SAE)
2018-present	P.Eng., Ontario.
2017- 2019	Member, Ontario Society of Professional Engineers (OSPE).
2017-2019	Member, International Society of Automation (ISA).
2015-2018	Member, CAUT.
2016-present	Member, IEEE.
