

# Alex Patel

alexdpatel2000@gmail.com | 224-730-1080 | linkedin.com/in/alexdpatel

## SUMMARY

---

Simulation engineer specializing in flexible-body modeling, multi-body dynamics, and durability analysis for large-scale machinery. Provides simulation insights to support design decisions and field failure investigations.

## WORK EXPERIENCE

---

### Senior Associate Engineer

March 2025 – Present

*Caterpillar Inc.*

*Champaign, IL*

- Owned development and integration of flexible bodies for large structural components within multi-body dynamics models, executing time-series load cases to evaluate fatigue damage against durability targets.
- Developed nonlinear Abaqus component-level models with bolted joints and contact interactions to investigate field failures and identify contributing factors.
- Applied virtual strain gauges and correlated simulation results with physical test data using Python-based post-processing to validate model fidelity.
- Supported print acceptance updates by assessing welded joint durability for robotic weld geometry deviations using fatigue analysis along weld crack planes.

### Metallurgical Analysis - Engineering Rotational Program

October 2024 – February 2025

*Caterpillar Inc.*

*Peoria, IL*

- Conducted PPAP evaluations of supplier parts using mechanical, chemical, and metallographic testing to verify material compliance.
- Performed failure analyses using fractography and SEM to identify crack initiation sites, fracture modes, and root cause factors.
- Evaluated robotic welds unsuitable for ultrasonic inspection. Assessed porosity, fusion quality, and penetration depth using macro-etching and Keyence optical measurement systems.

### Machine Development - Engineering Rotational Program

June 2024 – September 2024

*Caterpillar Inc.*

*Tucson, AZ*

- Coordinated maintenance, rework, and instrumentation workflows for test machines supporting ISO certification and structural validation programs.
- Designed and executed validation testing for an updated rear brake hydraulics configuration to reduce friction and leakage risk. Video analysis confirmed no line contact under full axle articulation.
- Validated a body support system on a pilot machine per ISO standards. Measured critical interfaces and authored the certification report enabling fleet-wide deployment.

### Large Structures Design - Engineering Rotational Program

February 2024 – May 2024

*Caterpillar Inc.*

*Decatur, IL*

- Evaluated tow hook designs under ISO towing loads using Creo Simulate and informed design changes to reduce peak stresses below yield.
- Designed a new steering box concept optimized for packaging and manufacturability. Conducted an on-site foundry visit to understand casting considerations, including core design and process limitations.
- Redesigned the rear support box with slotted features to enable robotic weld access around internal gussets and support full automation.
- Modified the rear support casting bore and dump body bracket location to reduce interface pin stresses below allowable limits.

## Large Structures Analysis - Engineering Rotational Program

August 2023 – January 2024

*Caterpillar Inc.*

*Champaign, IL*

- Conducted comparative fatigue analysis of pilot and previous-generation steering arms using multi-body dynamics models and representative composite work cycles.
- Supported root cause investigation of low-hour steering arm failures by developing a nonlinear steering assembly model with bolted joints and contact interactions. Replicated observed failure modes and ruled out geometric deviations as a primary contributor to reduced fatigue life.
- Implemented virtual strain gauges in flexible body simulation models aligned with the physical test gauge map.
- Prepared meshes for flexible body components supporting multi-body dynamics models.

## Undergraduate Research Assistant

March 2022 – May 2023

*Energy Transport Research Laboratory*

*Champaign, IL*

- Conducted experimental studies on oil–refrigerant separation under applied electric fields, assessing the impact of flow rate and field intensity.
- Simulated electric field distributions and correlated results with experimental oil–gas flow visualization.

## Chassis Structures and Advanced Calculations Intern

May 2022 – Aug. 2022

*Volvo Group*

*Greensboro, NC*

- Performed static structural analysis of an exhaust bracket and evaluated simulation accuracy by comparison with failed vibration test results.
- Built a comparative database of calculated linear and rotational stiffness for 80+ crossmember beams.
- Redesigned the fuel cell structure to integrate a crossmember without introducing packaging or structural issues.

## Chassis Structures and Advanced Calculations Co-Op

Aug. 2021 – Dec. 2021

*Volvo Group*

*Greensboro, NC*

- Supported crossmember concept feasibility through fatigue analysis using a multi-body truck model.
- Analyzed axle beam to identify potential failure locations and crack propagation paths.
- Developed a front closing crossmember concept to improve radiator airflow while meeting design constraints.
- Analyzed a spare tire carrier and reduced stress concentrations through gusset design.

## TECHNICAL SKILLS

---

**Simulation & Durability:** Altair HyperMesh, Abaqus CAE, NASTRAN, Ansys Mechanical, Creo Simulate

**CAD & PLM:** Creo Parametric, Teamcenter, SolidWorks, PTC Windchill, Autodesk Fusion 360

**Programming & Data:** Python, MATLAB, Linux

**Documentation & Tools:** Excel, PowerPoint, L<sup>A</sup>T<sub>E</sub>X, SharePoint

## EDUCATION

---

**University of Illinois at Urbana-Champaign**

Champaign, IL

*Bachelor of Science in Mechanical Engineering — GPA: 3.49/4.00*

*Aug. 2018 – May 2023*

- *Undergraduate Specialization in Computational Science and Engineering*

## PUBLICATIONS

---

V. S. Garimella, D. Yoo, T. Gebrael, H. Qiu, S. A. Haider, M. Olyaei, M. J. Hoque, **A. D. Patel**, W. A. Alleyne, J. Brownridge, and N. Miljkovic, “A hybrid mechanical-electrostatic separator for oil-refrigerant separation,” *Applied Thermal Engineering*, vol. 277, p. 127129, 2025, <https://doi.org/10.1016/j.applthermaleng.2025.127129>