PORTFOLIO

SHASHAANK YOGESH

MS MECHANICAL ENGINEERING
PURDUE UNIVERSITY

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Ph: 765-775-9065

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PERSONAL STATEMENT

I'M A MOTIVATED, PASSIONATE
MECHANICAL ENGINEER
LOOKING TO CREATE A
SUSTAINABLE FUTURE THROUGH
SMARTER, MORE EFFICIENT
DESIGNS

BACKGROUND

EDUCATION

Purdue University

Master of Science in Mechanical Engineering, GPA: 3.5/4

Specialization: Mechanical Design, CAE/ FEA

Courses:

- Multidisciplinary Design Optimization
- Computational Fracture Mechanics
- Modeling Damage in Materials
- Vibrations
- Fatigue
- Elasticity
- Finite ElementMethods
- Ergonomics
- Statistical Methods

Anna University | SSN College of Engineering

Bachelors of Engineering in Mechanical Engineering, GPA: 8.31/10

Leadership: Captain of Table Tennis Player, Sports Scholar

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EXPERIENCE

Intern - CAE, Simulating & Testing

Tesla
Jan 2019 - Aug 2019

- NVH CAE

Intern – Product Engineering

WABCO
Aug 2018 - Dec 2018

- Mechanical Design and analysis of steering gears

Graduate Researcher

Purdue University
Aug 2017 - Jul 2018

- Computational Modeling of Thermo-Mechanical Deformation

Mechanical Design Engineer

Purdue Hyperloop
Sep 2017 - May 2018

- Chassis and Structures Design

EXPERIENCE

Intern – Summer Research

Indian Institute of Technology, Kanpur
Jun 2016 – Aug 2016

- Design of De-spinning mechanisms for projectiles

Intern – Mechanical Engineering

Precision Equipment Private Limited
Nov 2015 – Dec 2015

- Thermal Rating of Heat Exchangers

Intern – Mechanical Engineering

India Pistons Limited
May 2015 – Jun 2015

- Piston Quality and Assembly Line Design

Intern – Mechanical Engineering

Ashok Leyland Trucks
May 2015 – Jun 2015

- Mechanical Design of Fixtures, Engine Assembly

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INDUSTRY PROJECTS

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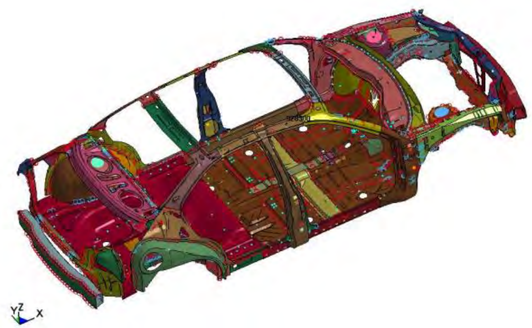
CAE INTERNSHIP AT TESLA



CAE MODEL BUILD

- Advanced Meshing and geometry repair
- Material models
- Connections (welds, bolts, adhesive, joints)
- Post processing

STRUCTURAL VIBRATION

- Modal Analysis
- Steady State Dynamics
- Random Vibration
- Linear, Static

CAE

FATIGUE

- High Cycle Fatigue

CRASH

- Pulse test
- Side Pole impact

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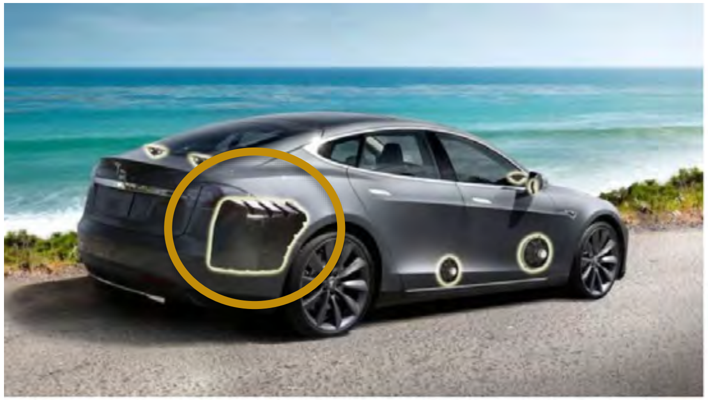
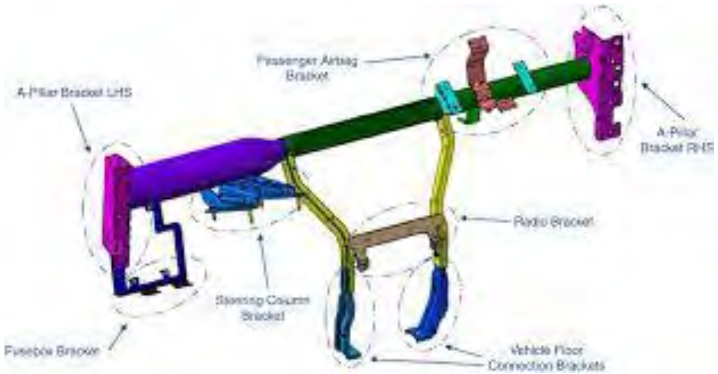
PROJECTS AT TESLA

SUBWOOFER DESIGN

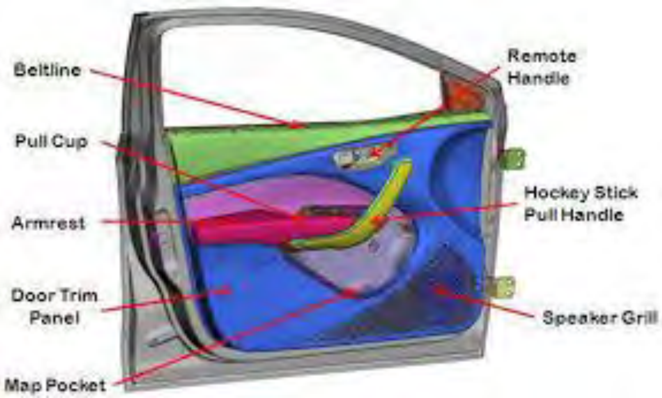


INSTRUMENT PANEL- DESIGN OPTIMIZATION



FULL-VEHICLE FINITE ELEMENT MODEL

FRONT DOOR PANEL – MODAL



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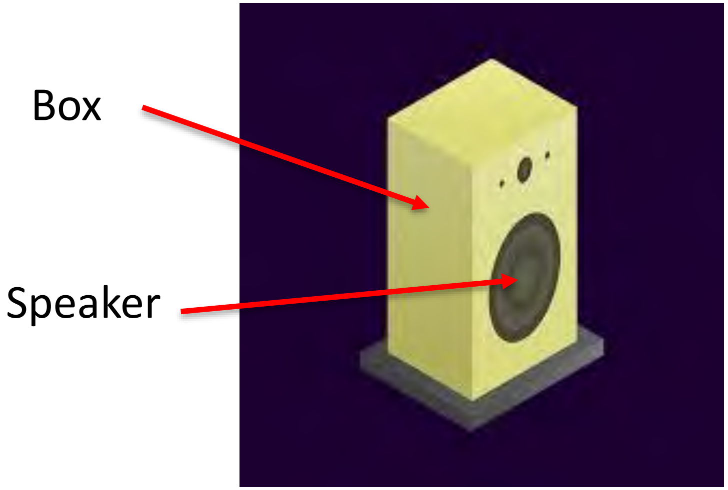
CAE INTERNSHIP AT TESLA

SUBWOOFER DESIGN



Geometry constraints

- Connection Points to Body-in-White
- Internal Volume of box
- Die-draw direction
- Ribs Thickness and location
- Wall Thickness

Material constraints

- Elastic Modulus
- Cost per kg
- Thermal Stability

Design Target

- Isolate displacement of speaker from box

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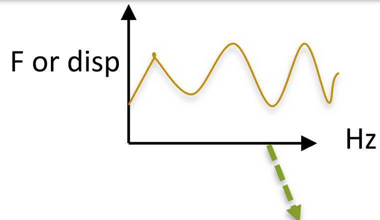
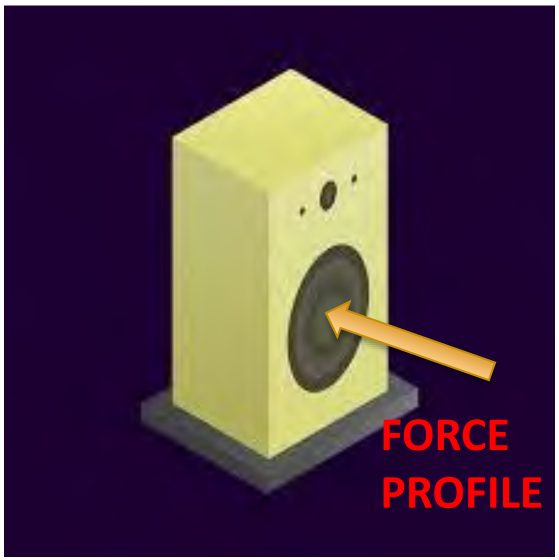
PROJECTS AT TESLA

SIMULATION PROCESS





Modal Analysis

Modal superposition

$$M\ddot{x} + C\dot{x} + Kx = F$$

Force/ Displacement Profile

Steady State Dynamics

Measure Isolation Ratio

Random Vibration

Measure RMS Stress

<u>Other Analyses</u>

- Pulse Analysis (explicit + damage)
- Drop Test (explicit)

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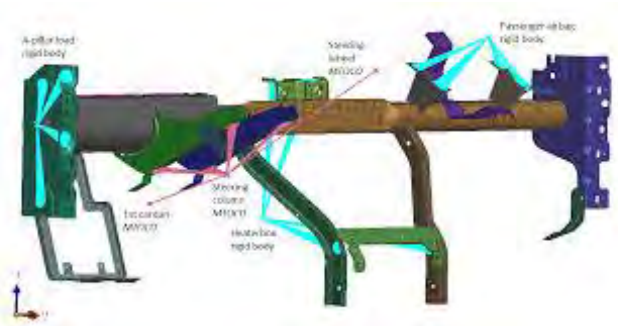
INSTRUMENT PANEL- DESIGN OPTIMIZATION



12 Parts (metal)

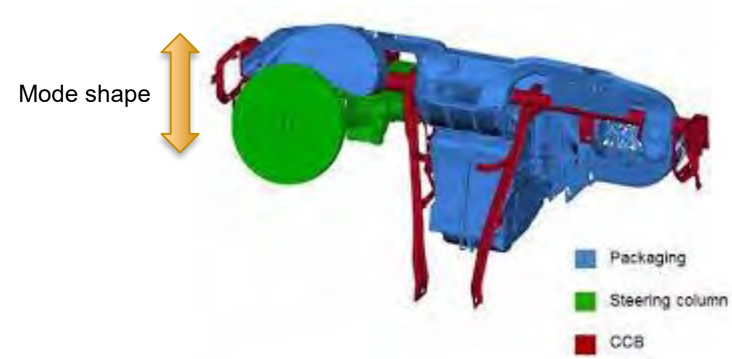
1 Part (Plastic)

Constraints

- Rib Thickness and location
- Wall Thickness
- Die-draw direction feasibility

Targets

- Same static stiffness
- Same Point Mobility (NVH) target
- Instrument Panel Sag
- Steering Column Z mode



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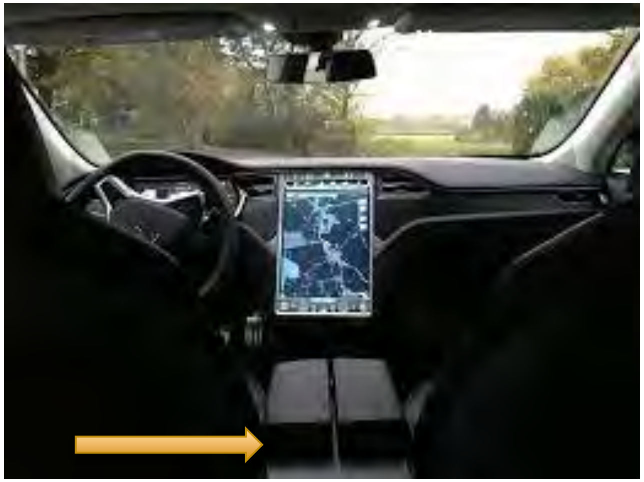
PROJECTS AT TESLA

OTHER ANALYSIS

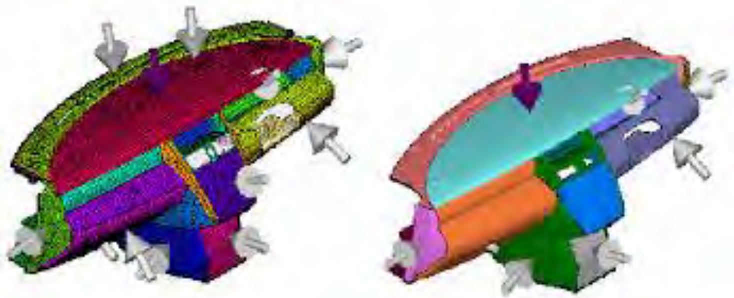
SEATS

STEERING COLUMN

CENTER CONSOLE



INSTRUMENT PANEL SAG



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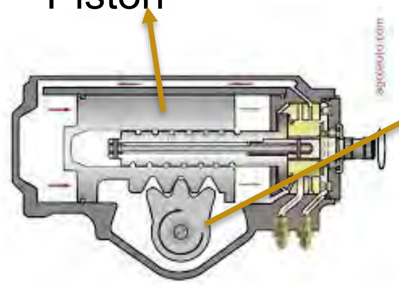
PRODUCT ENGINEERING INTERNSHIP AT WABCO

STEERING GEAR DESIGN

- **Mechanical design of sector shaft and piston**
  - Concept Designs
  - GD&T
  - Load Rating calculations
  - Gear fatigue life calculations
  - Tolerance and dimensioning
  - Design for manufacturing issues
  - FEM setup
  - Multi objective Design optimization

Piston

Sector Shaft



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ACADEMIC PROJECTS

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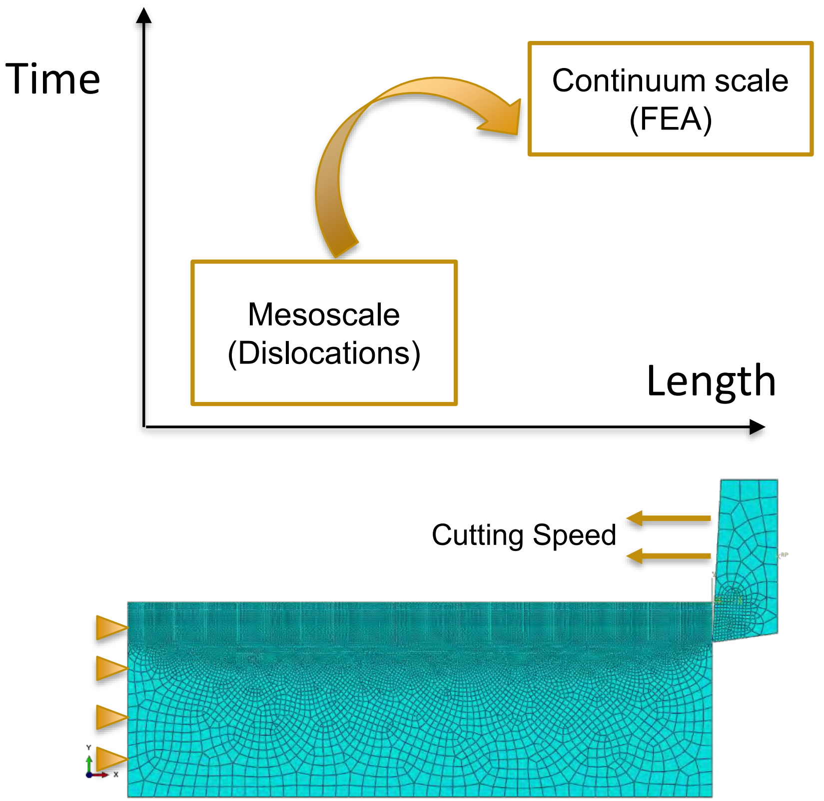
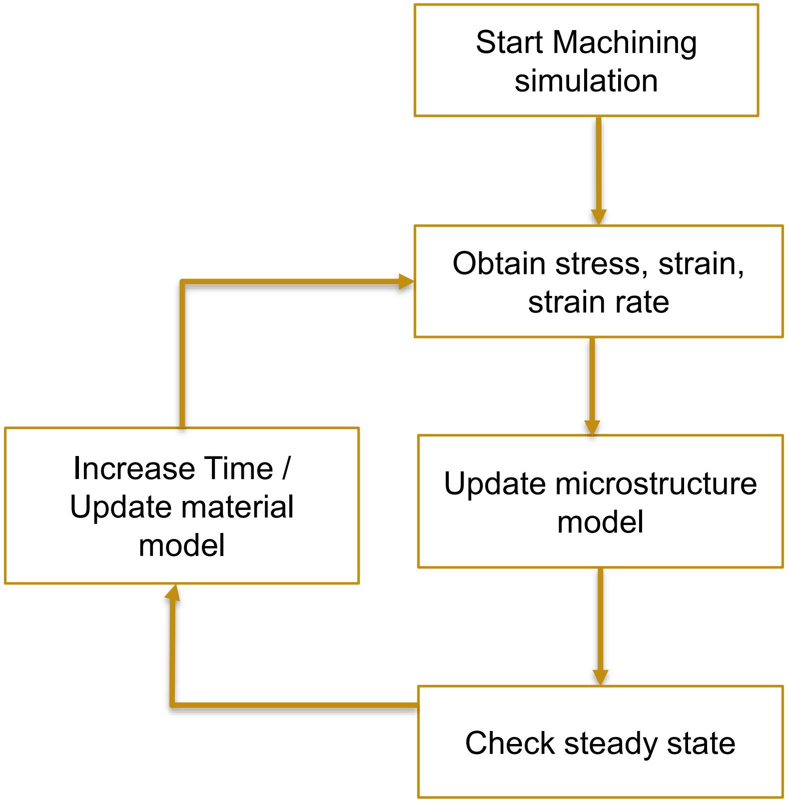
Microstructure based modeling of Machining of Copper[1]



Dislocation- Density based Constitutive Model

+

Johnson – Cook Ductile Damage Model



[1]Ding, Hongtao, Ninggang Shen, and Yung C. Shin. "Modeling of grain refinement in aluminum and copper subjected to cutting." *Computational Materials Science* 50.10 (2011): 3016-3025.

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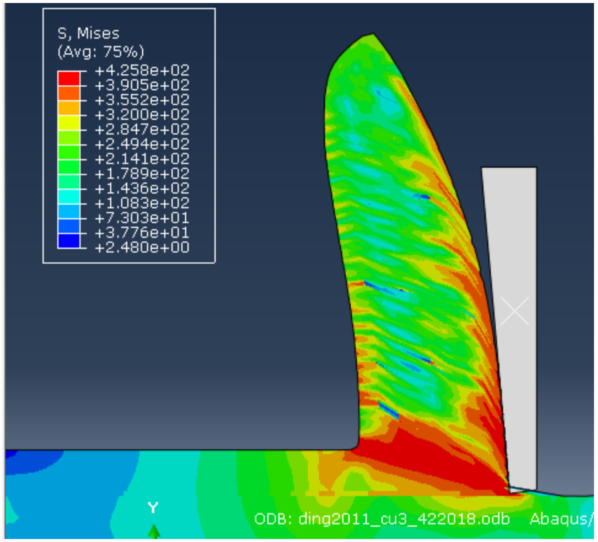
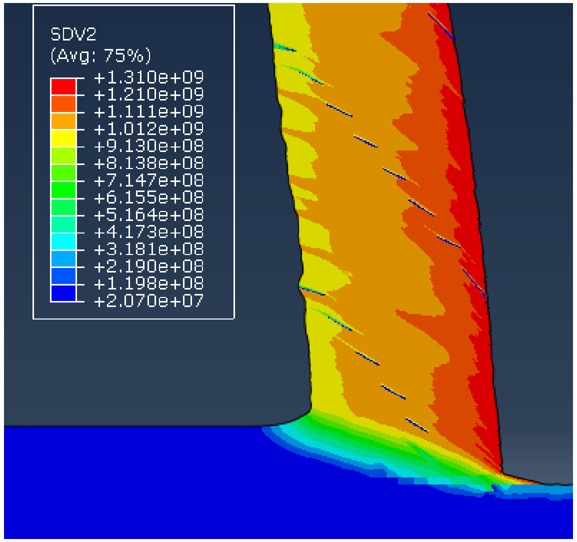
Microstructure based modeling of Machining of Copper[1]

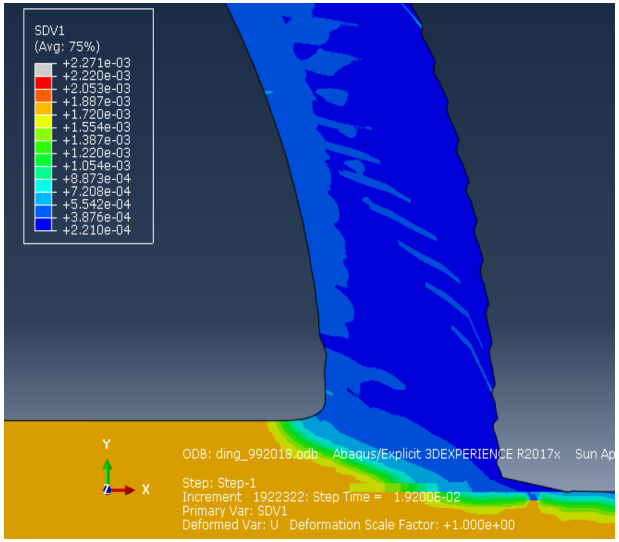
Stress Distribution



Dislocation Density



Grain Size



- Material Subroutine written in Fortran and linked with Abaqus
- Model to Predict Ultra-Fine Grain metals (10 nm scale)
- Dislocation Density Based Constitutive Model dictates the microstructure

[1]Ding, Hongtao, Ninggang Shen, and Yung C. Shin. "Modeling of grain refinement in aluminum and copper subjected to cutting." *Computational Materials Science* 50.10 (2011): 3016-3025.

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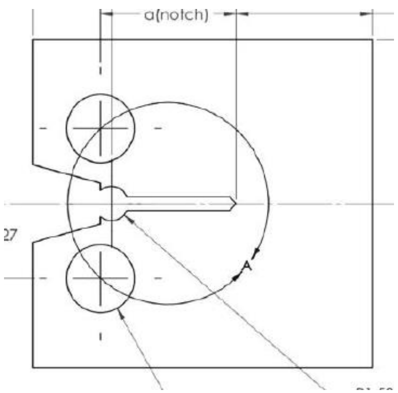
Elastic-Plastic Analysis of Compact Tension Specimen with crack growth and cohesive zone model



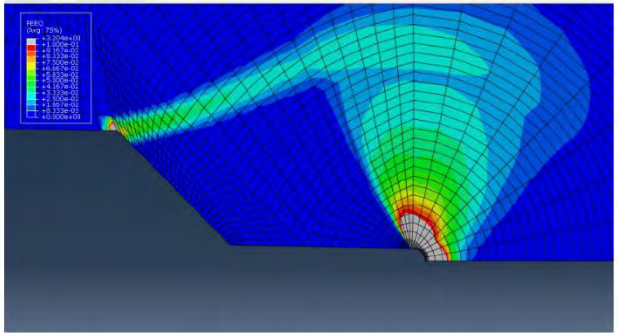
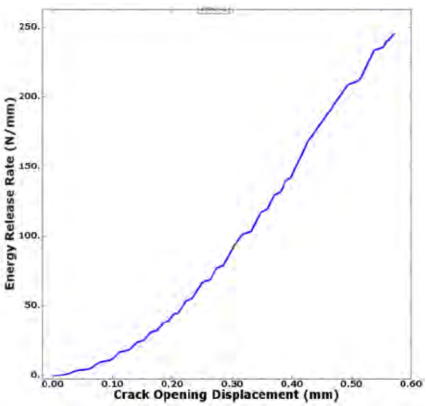
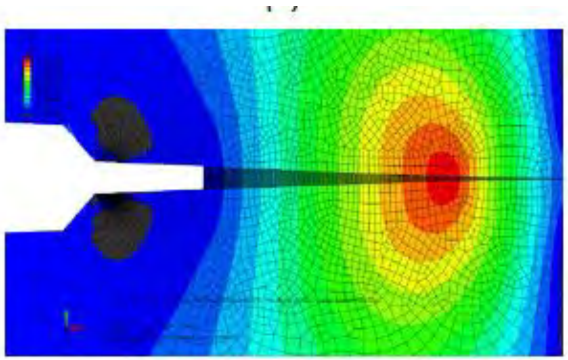
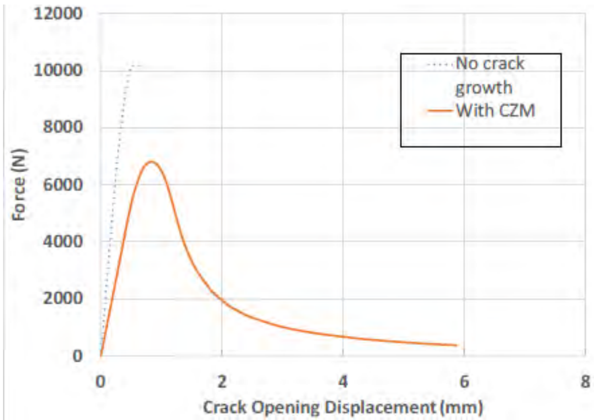


Figure 7: Deformed Mesh state showing eq. Plastic Strain values

- **Mesh:** Hybrid 8 noded plane strain reduced integration
- **Boundary Condition:** Displacement
- **Concepts:** J-Integral, Cohesive Zone Model







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Virtual Crack Closure Technique (VCCT) used in Single Edge Notch Specimen Test

- Virtual Crack Closure Technique
- Singular Collapsed Elements

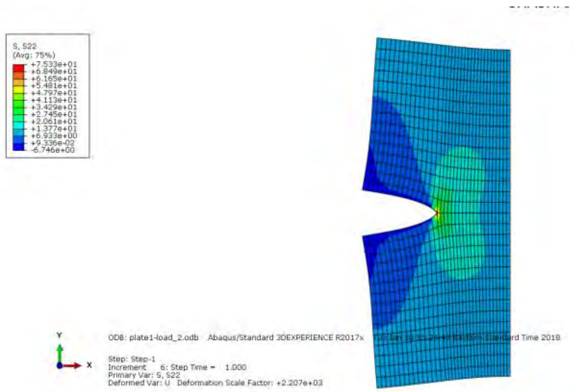
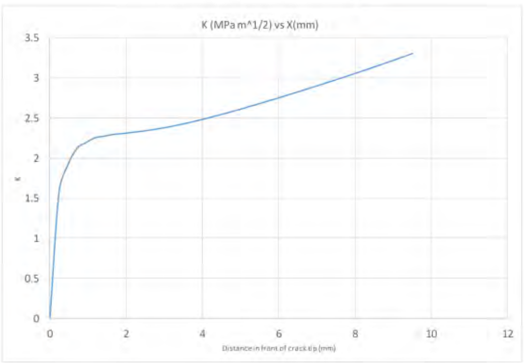


Figure 9: Opening stress distribution S22 for H/W=1

$\boxed{K_I = \sigma_y \sqrt{2\pi r} \ldots . \theta = 0}$



Stress Intensity Factor Plot

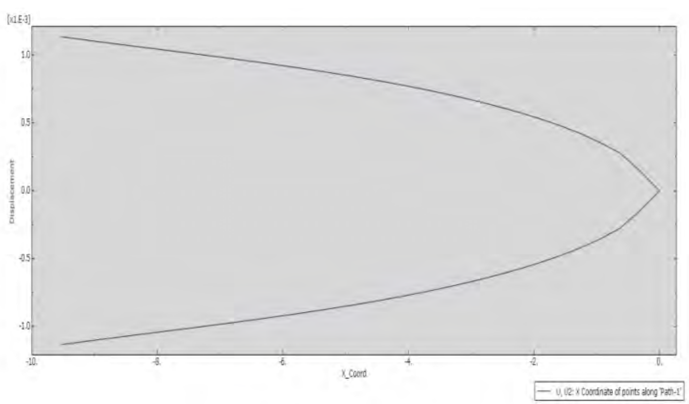
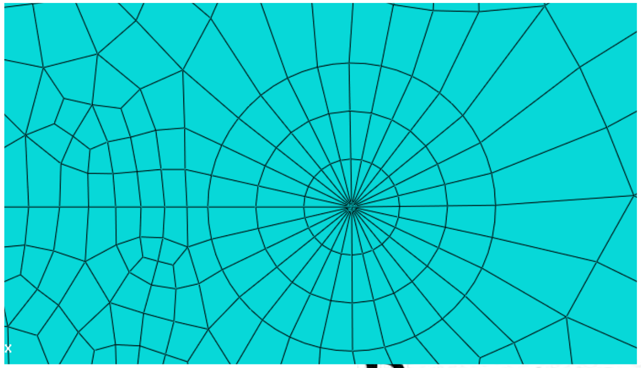


Figure 5: Displacement behind crack tip



Collapsed Elements

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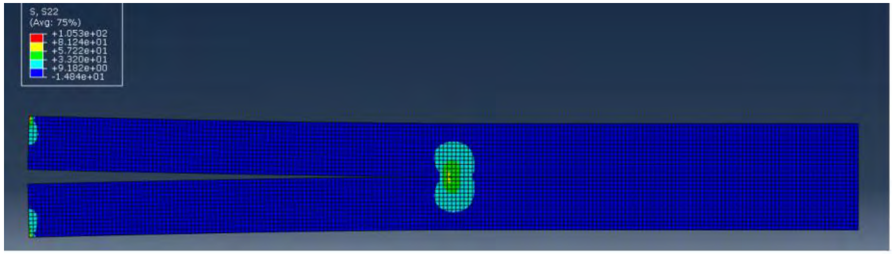
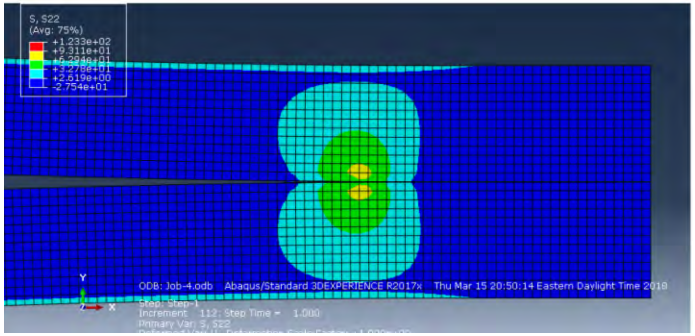
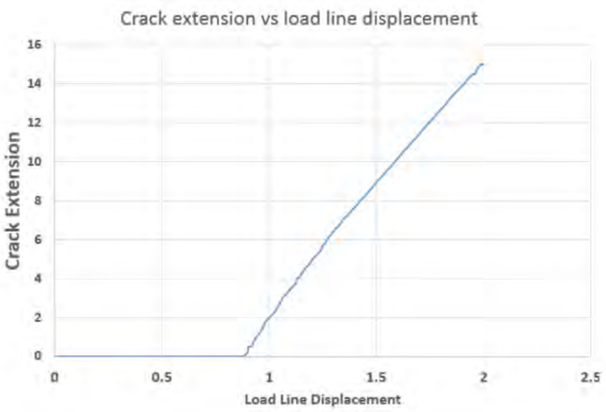
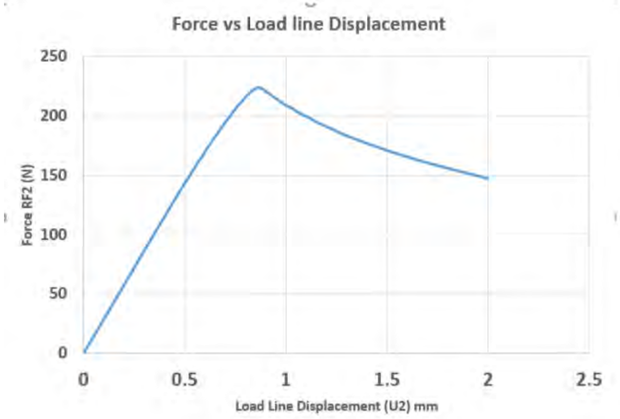
Crack Growth in a Double cantilever Beam specimen using cohesive zone model









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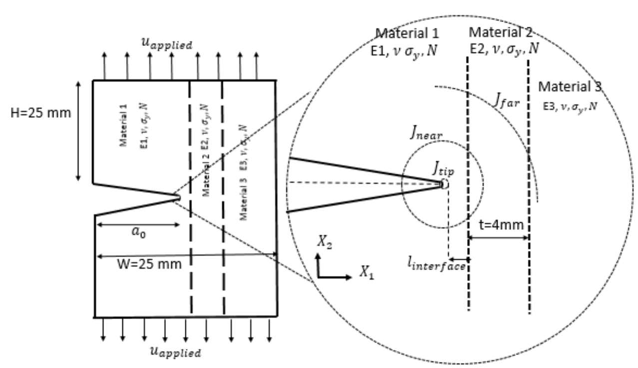
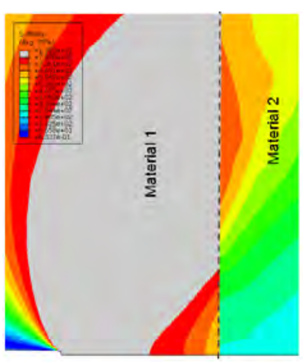
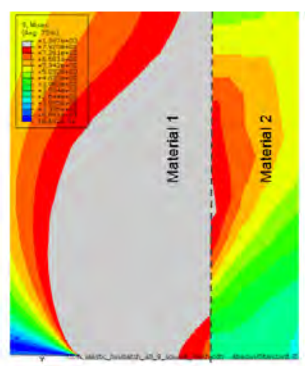
Crack Amplification and Shielding in Material interface

- Determined crack amplification and shielding factors in a material interface (discontinuous properties)



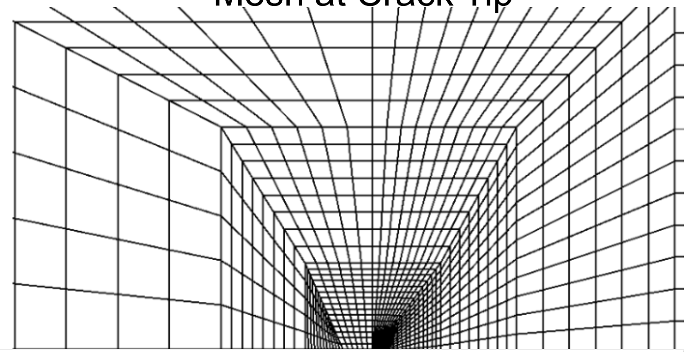


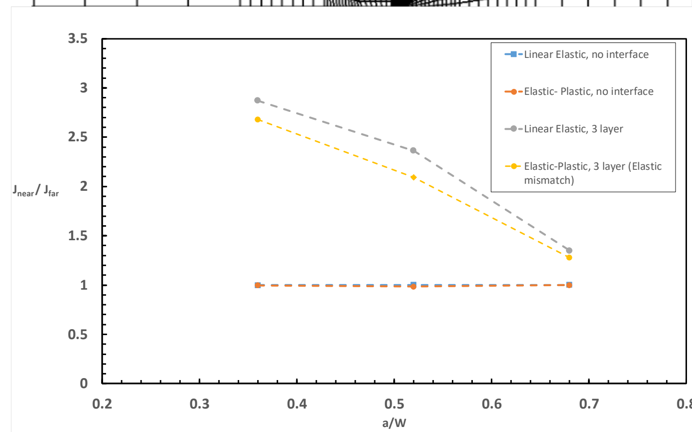
σ_{mises} *at load factor* 0.6
No yielding in material 2



σ_{mises} *at load factor* 0.66
Yielding starts in material 2

Mesh at Crack Tip





Energy Release Rate vs. Initial Crack length

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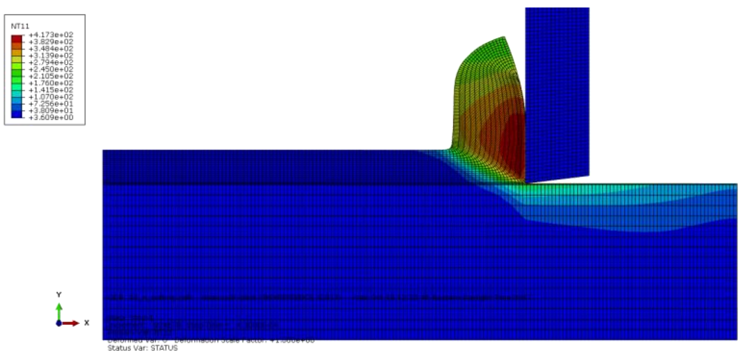
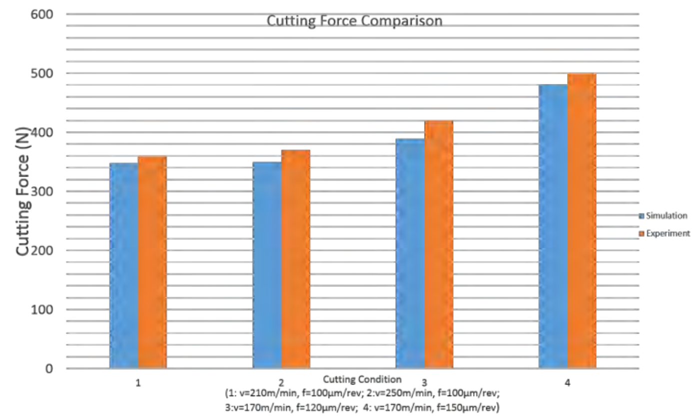
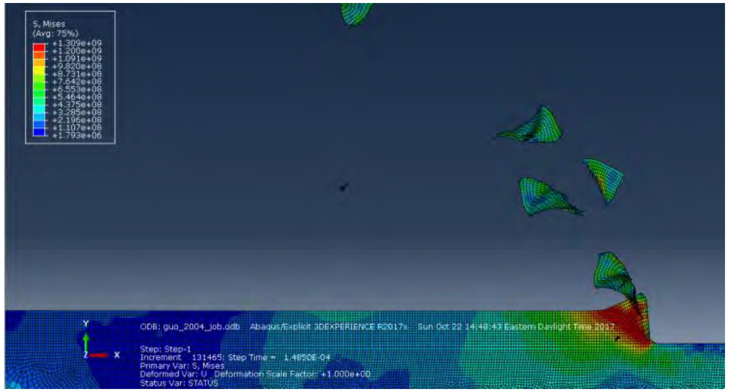
Simulation of 2D machining using Johnson- Cook Plasticity Model and Ductile Damage Model



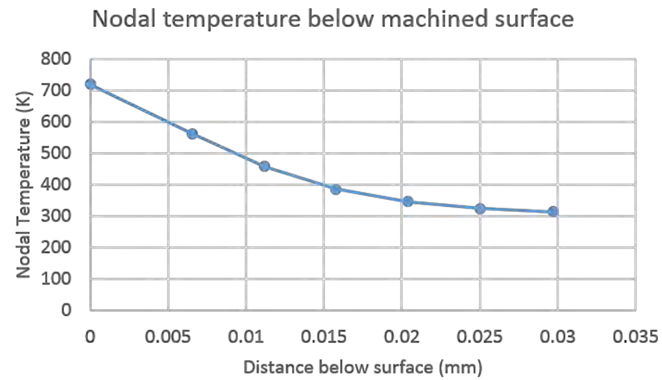
Continuous chip formation



Cutting Force Validation



Discontinuous chip formation at High cutting Speed



Temperature below Machined surface

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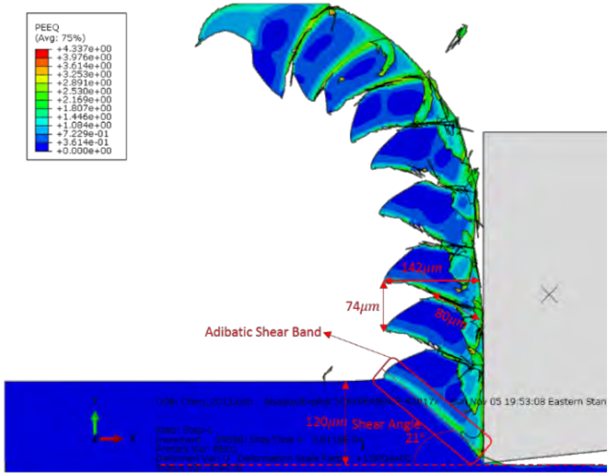
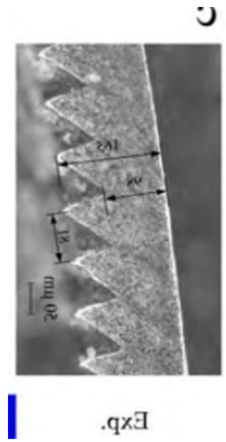
Serrated chip formation in high speed machining of Ti-6Al-4V

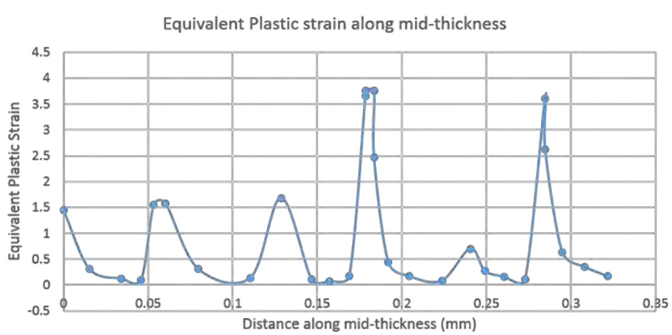
Simulation



Experiment



Cutting Force Validation



Plastic Strain Distribution across chip region

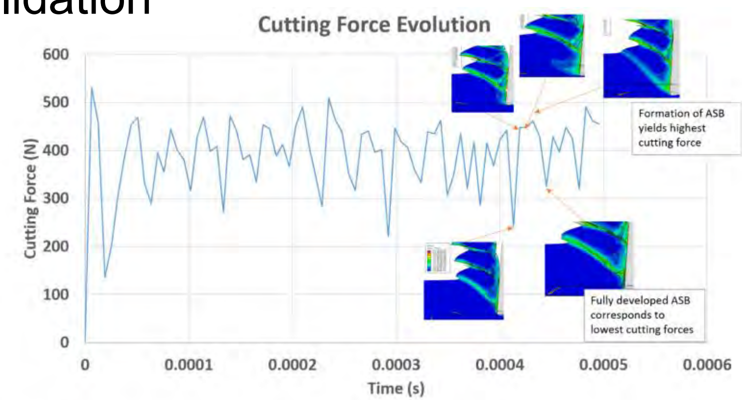
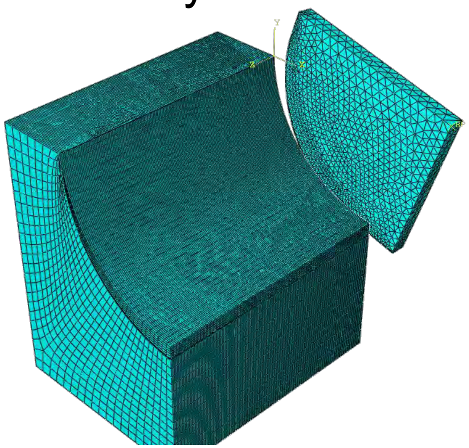


Figure 8: Evolution of shear band and the corresponding cutting force values for for feed: 120μm/rev and cutting speed: 170 m/min

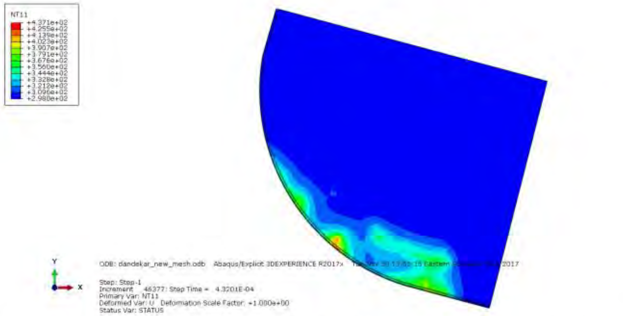
U N I V E R S I T Y

Simulation of 3D Laser Assisted Machining

Geometry + Mesh

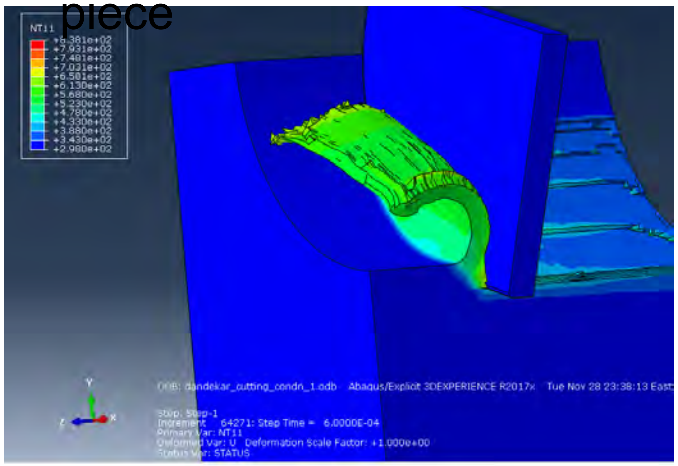


Temperature across tool



e 4: Temperature distribution in Kelvin on tool rake face for cutting speed=107m/min and depth cut=0.76mm

Temperature across work piece



Validation of Results

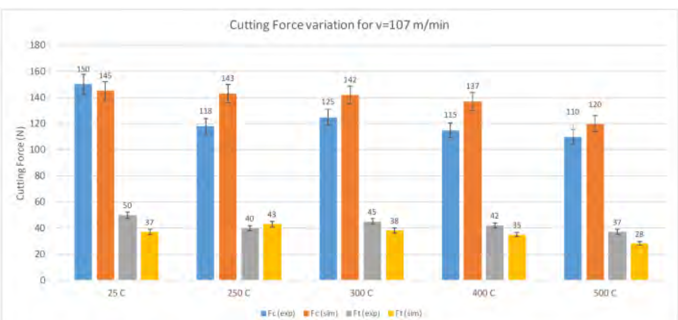


Figure 6: *Cutting Force Comparison for d.o.c = 0.75mm, f=0.075mm/rev and Cutting Speed 107m/min*

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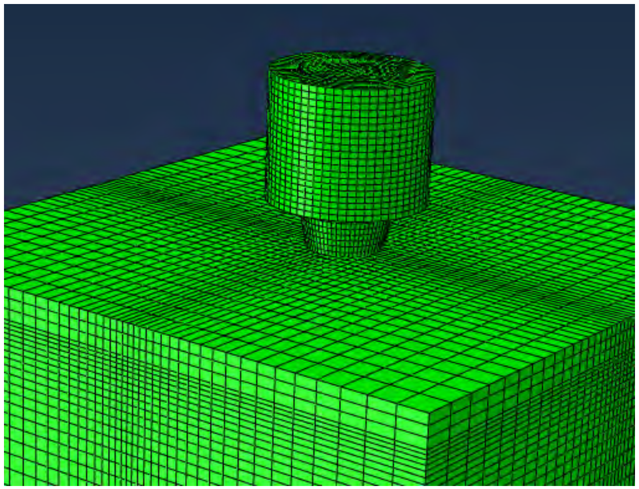
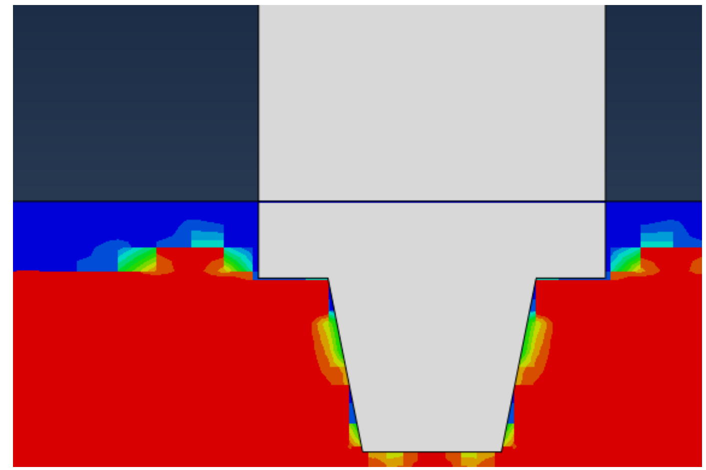
Modeling 3D Friction Stir Welding[1]

Geometry + Mesh



Void Fraction of Material

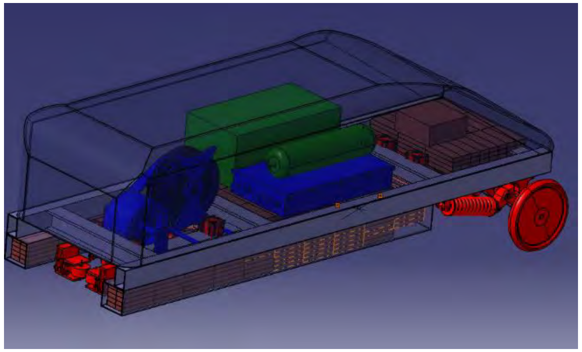


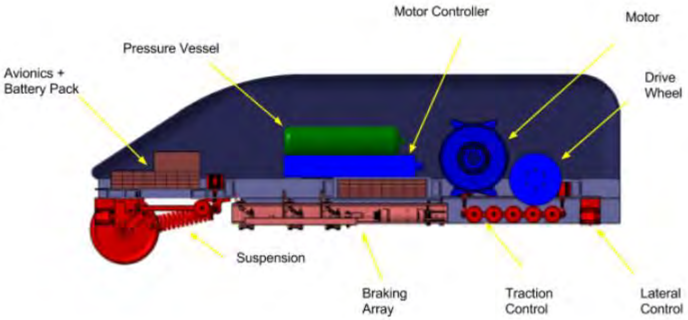
- Coupled Eulerian Lagrangian Method
- Johnson Cook Plastic Model
- Boundary Condition: Tool RPM + Feed
- Currently Implementing ALE Technique to study microstructure refinement and recrystallisation

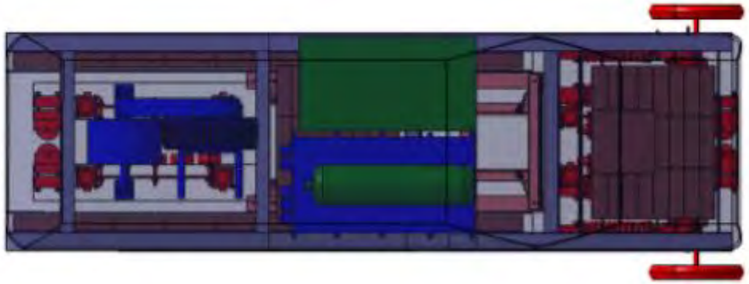
[1]Ajri, Abhishek, and Yung C. Shin. "Investigation on the effects of process parameters on defect formation in friction stir welded samples via predictive numerical modeling and experiments." *Journal of Manufacturing Science and Engineering* 139.11 (2017): 111009.

Structural Design of Hyperloop Pod

- Responsible for Chassis design, analysis, assembly design
- Simple ladder frame design to account for modifications during manufacturing







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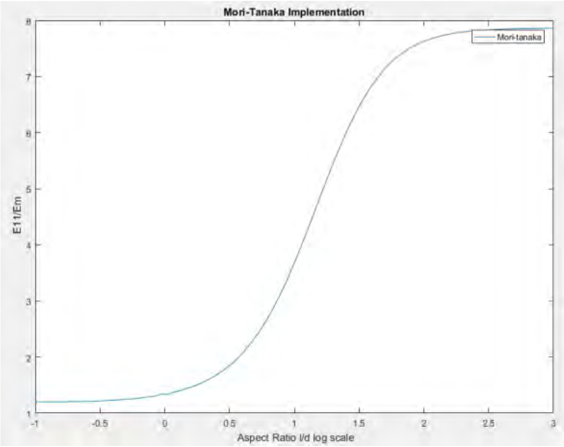
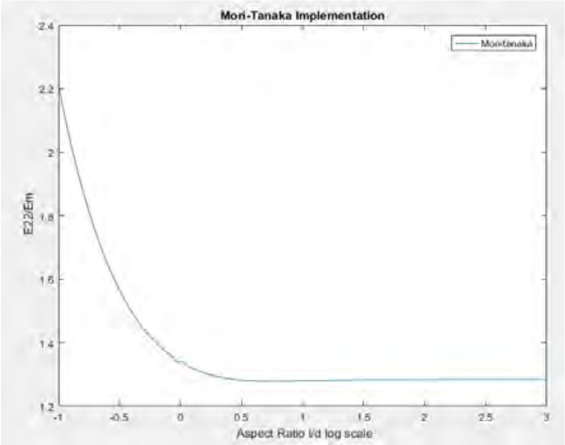
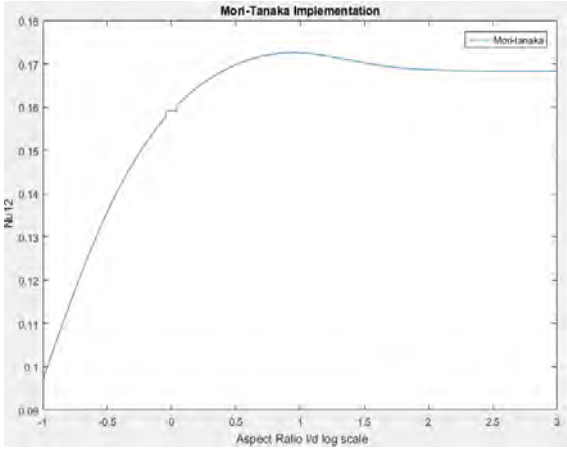
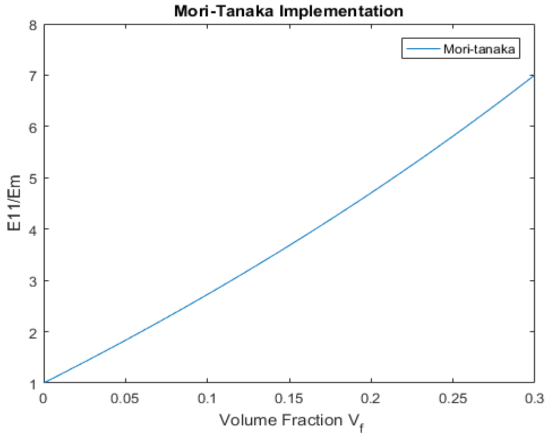
Stiffness Prediction of Uni-directional Composite using Mori- Tanaka Micromechanical Model

- Random Aspect Ratio of Fiber
- Based on Eshelby Problem









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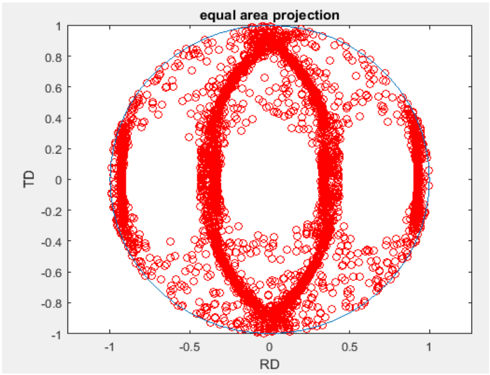
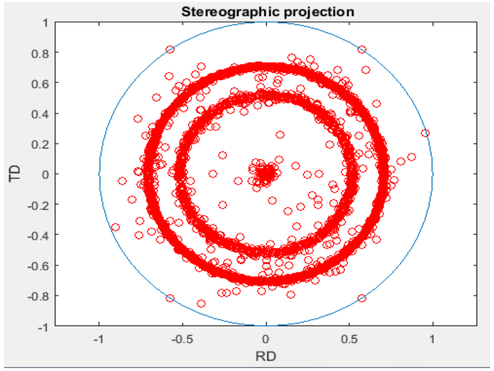
Rate Dependent Viscoplastic Model For Texture Evolution

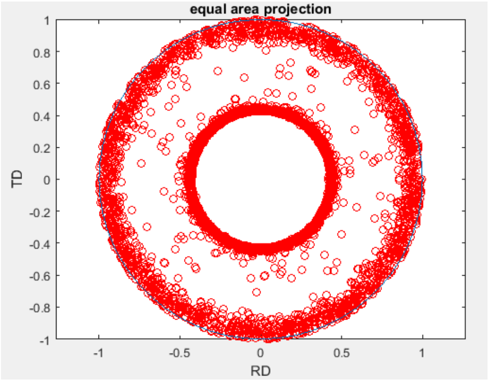
- To obtain a texture plot when a material undergoes different deformation modes
- Can be readily implemented as a crystal plasticity model in FE Code



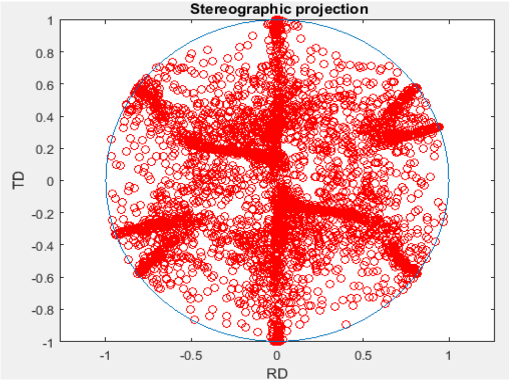
Plane Strain Compression



Uniaxial Tension



Uniaxial Compression



Simple Shear

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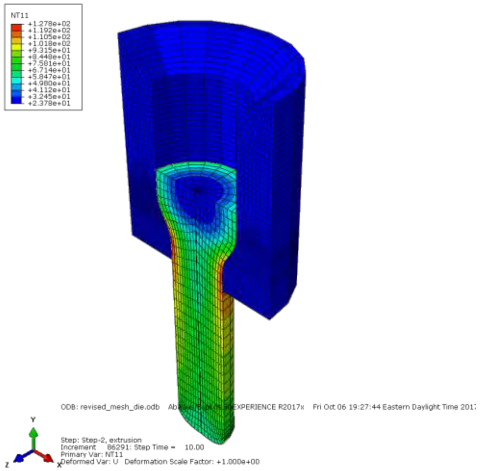
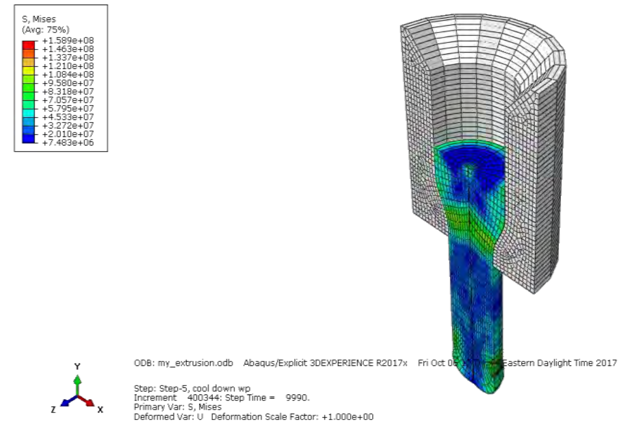
Simulation of Metal Forming using Arbitrary Eulerian Lagrangian (ALE) Technique

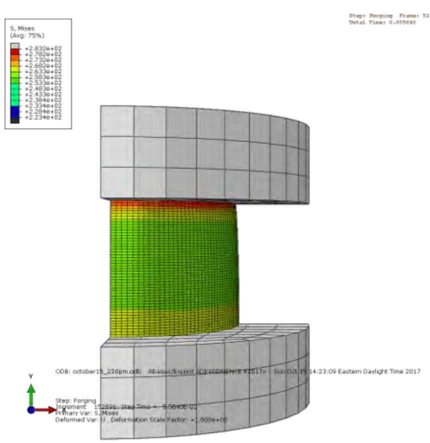
Forward Extrusion

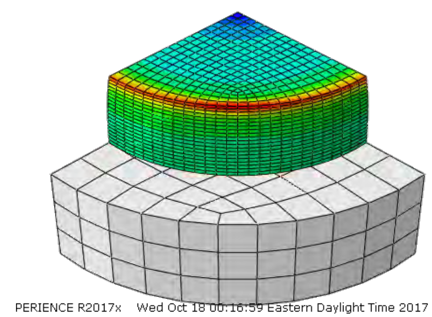




Temperature Plots

Forging





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Wood Plastic Composite for 3D Printers

- Optimizing composition, process parameters
- Hands-on experience in using a twin screw injection molding machine
- Made the samples and conducted mechanical tests (tensile, density, hardness)
- Published a conference paper
- Made from waste sawdust!

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QUESTIONS?

Email me at shashaankyogesh@gmail.com

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