



Irfan Habeeb C N



India



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Personal website



Researchgate

Profile

Expert in engineering design, researcher with 5+ years of experience in experimental-computational mechanics and programming.

Interests & Skills

- FEA & CAE
- Fracture mechanics
- Image processing
- Programming - Matlab, Python, Fortran, and Javascript
- Machine learning (beginner)

Education

- PhD in Mechanical Engineering, Technion IIT, Israel. (2016 - 2021)
- Masters in Aerospace Engineering, IIT Madras, India. (2014 - 2015)
- Bachelors in Aerospace Engineering, IIT Madras, India. (2010 - 2014)

Experiences

Doctoral fellow: (Technion - Israel Institute of Technology, Oct 2016 - Feb 2021)

- ✓ The PhD is funded by **Marie Skłodowska-Curie ITN-ETN** scholarship from European Union (Horizon 2020) involving a collaboration of 3 universities and 5 industries including Airbus Defense & Space and Rafael Advanced Defense Systems Ltd.
- ✓ Objective of the PhD was to use the concept '*Design to Demise*' to fail a system in a controlled manner using experiments and simulations.
- ✓ Development and validation an accurate model to predict the damage of ceramics.
- ✓ Use of experimental - computational techniques, material modeling, and image processing.

Internship: (*Airbus Defense & Space, Madrid, July - Sept 2019*)

- ✓ Worked on a numerical model of a component in the stage separation unit of the satellite launcher using Abaqus and SolidWorks.
- ✓ Created a model to analyse the thermomechanical properties under extreme loadings.
- ✓ Implemented the model using finite elements in Abaqus with a custom subroutine.

Research collaborations:

1. LEM3 - University of Lorraine, France (Sept - Nov 2018)
 - ✓ Development and implementation a damage model using FEA for ceramics.
 - ✓ Demonstration of the capability of the model to predict the fracture pattern even for a complex geometry.
2. UC3M - University of Carlos III Madrid (June - July 2019)
 - ✓ Development of multiple material models using FEA and implemented in Abaqus software.
 - ✓ Studied different finite element programs to implement multiple material models.

Research assistant: (*NIOT India, Apr - Sept 2016*)

- ✓ Developed the control system for the motion of a robotic fish for underwater exploration.
- ✓ Implementation of PID control system using Matlab Simulink.

Masters thesis: (*IIT Madras India, Apr - Sept 2016*)

- ✓ Strength distribution of planar local-load sharing bundles.
- ✓ Numerical analysis and modeling of the failure patterns in uniaxial fibrous composite under axial load to predict the macroscopic composite properties using Monte-Carlo simulations.

Projects

3D modeling and testing of metals and ceramics (CAD & FEA):

- ✓ Numerical analysis and testing to analyse the fracture in metals and ceramics, in order to control the material damage.
- ✓ Developed tools to detect the crack path and fracture properties using image correlation.

Fracture of 3D printed polymers:

- ✓ Experimentally studied the properties of 3D printed materials and sandwich structures.
- ✓ Generated a database on the role of loading rate in the nature of fracture.

Sheet metal forming – Thermomechanical analysis:

- ✓ Development of a numerical model to predict the failure of sheet metals under different environmental conditions to evaluate the limit of deformation (FLD).
- ✓ Quantified the influence of strain rate, temperature, and friction on the fracture.

Structural analysis of lattice structures (metamaterials):

- ✓ Investigation of the material properties of the gyroid geometry (curved lattice structure) and the development of yield curve using FEA.

Fracture of Silicon Carbide:

- ✓ Evaluated the fracture characteristics of SiC with experiments and highspeed photography.

Developed tools

The tools are public at <https://github.com/irfancn>.

- **Material model (FEA):** Subroutines in Abaqus (VUMAT&UMAT) with strain rate, temperature and shear stress dependencies using damage models.
- **Damage model (FEA):** User element subroutine for Abaqus (UEL) to implement the Phase Field Model.
- **Matlab codes:** Assessment of fracture characteristics such as crack path and fracture energy release rate from testing using Digital Image Correlation.
- **Abaqus subroutines:** Cohesive Zone, Viscoelastic material and Johnson-Cook material models developed using FEM for thermomechanical analysis.

Scientific events

- **Conference & symposium:**
 - "*Reliability of fibre bundles*". Talk at PRAVARTANA conference - Irfan Habeeb and S. Mahesh, at Indian Institute of Technology, Kanpur (March 2015).
 - "*Crack-flaw interactions in brittle materials under brittle fracture*", 22nd European Conference on Fracture (ECF22), Serbia (Aug 2018).
 - "*Damage and Failure Mechanics: from Microstructure to Macroscopic Response*", symposium within the framework of the EMI 2016 International Conference, Lorraine, France (Oct 25-28, 2016).
 - "*Damage and failure of engineering materials under extreme loading conditions*" (605), Madrid, Spain (May 21-24, 2019).
- **Industrial workshop:**
 - "*Extreme structural mechanics in Aerospace applications*", Getafe, Spain (June 22-23, 2017).
 - "*Extreme Structural Mechanics in defense applications*" held at Technion – Israel Institute of Technology, Haifa, Israel (Feb 6, 2018).
- **Summer school:**
 - "*European Conference on Fracture*" (ECF 22), Belgrade (Aug 25-26, 2018).

Research articles

- "Strength distribution of planar local load sharing bundles" - C. N. Irfan Habeeb and S. Mahesh, *Physical Review E*, 2015. 92(2):022125.
- "Experimental and numerical study of the interaction between dynamically loaded cracks and pre-existing flaws in edge loaded PMMA specimens" - C. N. Irfan Habeeb and Shmuel Osovski, (*International Journal of Image Engineering*, 2021, 103973, ISSN 0734-743X).
- "Effect of strain rate on fracture using 3D printed soft materials" - C. N. Irfan Habeeb, V. Slesarenko, S. Osovski and S. Rudykh. (in Preparation).
- "Effect of strain rate on metal forming using GTN damage model"- C. N. Irfan Habeeb, S. Osovski (in preparation).

Achievements

- **Marie Skłodowska-Curie ITN-ETN** scholarship from [Project ITN OUTCOME](#) organized by European Union's Horizon 2020 research and innovation program.
- All India Rank 89 in Graduate Aptitude Test in Engineering - 2014 (top 0.5%).

Hobbies

- Football, robotics, occational reading and standup comedy.

Personal vitae

Nationality	Indian
Languages	English (C2), German (A1)