



# Gurudas Kar

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## Research Interests

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Physics-based and phenomenological models for viscoplasticity of metals and alloys, Non-equilibrium thermodynamics in material modeling, Machine learning in crystal plasticity modeling, Continuum damage modeling, Structural health monitoring.

## Experience

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### Graz University of Technology

June 2022 – Present

*Postdoctoral Researcher*

*Graz, Austria*

- Development of machine learning algorithms in Continuum Dislocation Dynamics.

### Indian Institute of Science Bangalore

August 2015 – June 2022

*Research Associate and Ph.D. Thesis*

*Bangalore, India*

- Developed non-equilibrium thermodynamics based viscoplastic models for metals and alloys.
- Simulated homogeneous deformation using Matlab and developed Fortran-based user material subroutines (VUMAT) to solve boundary value problems in Abaqus.
- Demonstrated the effect of grain boundary in severe plastic deformation for both BCC and FCC metals.
- Constructed numerical codes for plastic deformation to resolve research projects under the Defence Research and Development Organization (DRDO) and Indian Space Research Organisation (ISRO).
- Developed and analysed finite element models in Abaqus to determine elastic properties by an inverse problem on soft tissue to predict cancer cells.
- Mentored 50 M. Tech and Ph.D. students for Mathematics for Engineers course (CE-211) at IISc Bangalore.
- Utilized effective writing of funding proposals and technical reports resulting in the receipt of an outreach training research during Ph.D. program.

### Fluor Daniel India Private Limited

July 2014 – July 2015

*Structural Design Engineer* | Project: TengizChevroil (TCO)

*Gurgaon, India*

- Designed pipe racks, modules for MTO.
- Tabulated document for pile and foundation design.
- Consolidated detailed design document with an analysis for steel pipe rack

### Indian Institute of Technology Kharagpur

July 2012 – May 2014

*Masters Thesis Project*

*Kharagpur, India*

- Performed modal testing on floors with different boundary conditions and developed finite element models in Abaqus.
- Compared the experimental mode shapes and natural frequencies with finite element models in Abaqus
- Performed finite element model updating manually and with FEMtools.
- Worked as a teaching assistant for design of concrete structure and design project on building complex.

## Education

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### Indian Institute of Science Bangalore, India

August 2015 – June 2021

*Doctor of Philosophy in Civil Engineering (Structures)*

*Bangalore, India*

Dissertation title: Two-temperature thermodynamics and continuum modelling of viscoplasticity in metals.

### Indian Institute of Technology Kharagpur

July 2012 – May 2014

*Master of Technology in Civil Engineering (Structures)*

*Kharagpur, India*

Dissertation title: Finite element model updating of building floors using experimental modal testing.

### Bengal Engineering and Science University, Shibpur, India

July 2008 – May 2012

*Bachelor of Engineering in Civil Engineering*

*Shibpur, India*

## Publications

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- **Gurudas Kar**, S. Bhushan Tiwari, S. Rao G, and Debasish Roy, *Two-temperature thermodynamics and a viscoplasticity model for FCC metals with grain boundary effect*, (revision submitted) .
- **Gurudas Kar**, Debasish Roy, and J. N. Reddy, *Thermoviscoplasticity in body-centered cubic metals: a two-temperature model with grain boundary evolution*, Journal of Applied Mechanics, 111004, 87(11), **2020**.
- **Gurudas Kar**, Shubhankar Roy Chowdhury, and Debasish Roy, *A nonequilibrium thermodynamic model for viscoplasticity coupled with damage for BCC metals*, Mechanics of Advanced Materials and Structures, 1-10. (**2020**).
- Shubhankar Roy Chowdhury, **Gurudas Kar**, Debasish Roy, and J. N. Reddy, *Metal viscoplasticity with two-temperature thermodynamics and two dislocation densities*, Continuum Mechanics and Thermodynamics, 397-420, 30(2), **2018**.
- Shubhankar Roy Chowdhury, **Gurudas Kar**, Debasish Roy, and J. N. Reddy, *Two-temperature thermodynamics for metal viscoplasticity: continuum modeling and numerical experiments*, Journal of Applied Mechanics, 011002, 84(1), **2017**.
- Dibbyan Mazumder, **Gurudas Kar**, Ram Mohan Vasu, Debasish Roy, and Rajan Kanhirodan, *Orthotropic elastic moduli of biological tissues from ultrasound-assisted diffusing-wave spectroscopy*, JOSA A 34, no. 11 (**2017**): 1945-1956.

## Oral Presentations & Conferences

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- A continuum model of viscoplasticity based on non-equilibrium thermodynamics, **WCCM-ECCOMAS congress**, virtual conference, Paris, France 2020.
- Two-temperature thermo-viscoplastic and damage model for bcc metal, **Workshop on Non Classical Mechanics of Materials**, IISc Bangalore, India, 2019.
- Viscoplasticity Model for Metals with two-temperature Thermodynamics, **First International Conference on Mechanics of Advanced Materials and Structures (ICMAMS 2018)**, Turin, Italy, 2018.

## Expertise

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**In-depth knowledge:** Multiscale modeling, Finite element analysis, Computational mechanics, Structural health monitoring

**Languages:** Fortran, Python, Matlab

**Software Tools:** Abaqus, FEMtools, Risa 3D, STAAD.Pro

## Fellowships & Awards

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- Postdoc Fellowship 2021, for conducting research at Imperial College London (could not avail).
- Science and Engineering Research Board (DST-SERB) travel grant to attend the First International Conference on Mechanics of Advanced Materials and Structures (ICMAMS-2018), Turin, Italy.
- Awarded CSIR fellowship in National eligibility test (2012) with rank 189 among all engineering disciplines
- Graduate Aptitude Test in Engineering (GATE) fellowship for master's programs to the IIT's and IISc. in Civil Engineering, (2012-14).
- Awarded National merit scholarship at school level (Class VII, 2004).

## Interests & Hobbies

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- Core Committee Member, INSTRUO (2010), annual techno-management festival of BESU, Shibpur.
- Member of the Institute of Engineer, India.
- Actively involved in the IISc Cricket team.
- Passionate about Photography and English Premier League football.