Amalgamation of Rubber / Elastomer / Polymer Material, Product Testing and Simulation Community

## International Conference on **Rubber Testing & CAE Simulation**

22nd - 23rd May 2025, **Bangalore India** 

### **Pre-Conference Workshops**

Workshop 1: Hyperelastic Material Modelling and Simulation

Workshop 2: Molecular Dynamics & RVE Simulation based and Material Characterisation

Workshop 3: Principles for Simulating Elastomer Durability

Workshop 4: Tyre Durability Simulation - Endurica Workflow

Workshop 5: Material Modelling for Tyre Industry

Workshop 6: Best Practices of Rubber Material Testing for Strength and Durability



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#### About the conference

In today's fast-paced and competitive market, there is a constant demand for high-performance engineered products that are designed within shorter timeframes, yet offer longer life, enhanced durability, reduced costs, and improved performance. To meet these evolving demands, designers, engineers, and researchers are exploring advanced technology simulation techniques, innovative material and cutting-edge manufacturing technologies to create the next generation of rubber-based products.

Rubber and elastomer materials play a crucial role in many industries, including automotive, aerospace, medical devices, consumer products, and industrial applications, due to their unique ability to withstand complex, nonlinear behaviors. This demands essential in designing products that must endure extreme conditions while maintaining high performance.

The nonlinear behavior of rubber and elastomers. characterized by their hyper-elasticity properties, allows them to deform and retain their original shape and size making them suitable for applications where resilience and flexibility are required. These unique properties contribute significantly to the advancement and efficiency of products across diverse industries.

RubberCAE India 2025 aims to foster knowledge-sharing among professionals in the field of rubber technology simulation and testing, exploring everything from material manufacturing and simulate testing protocols to computational modeling and advanced manufacturing techniques. The conference will provide a platform for industry leaders to exchange ideas, showcase the latest advancements, and discuss solutions for the future of rubber product design.

This conference aims to provide a platform for the rubber material characterization, testing, and simulation community to discuss material manufacturing, testing, and computational simulation. The event will feature:

- Keynote talks from National and International Experts
- Pre-Conference Workshops
- Panel Discussions
- Demonstrations on Testing, Simulation, and Material Technology

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#### A Glimpse of RubberCAE 2024



#### **Conference Theme** Wide Spectrum of Topics Covered

- Material Testing and Calibration
- Material Modelling and Simulation
- Finite Element Analysis
- Fatigue and Durability Testing
- Fatigue Life Computation
- Failure and Fracture Studies
- Rubber Part Manufacturing Process & Tooling
- In-situ Measurement
- Duty Cycle Development
- Aging Studies

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- Creep-Fatigue Interaction

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- Manufacturing Process Influence
- Temperature Influence on Rubber
- Diaital Transformation in Rubber Parts Manufacturina & **Mass Customization**

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### **Invited Eminent Speakers**

(**Partial List** - Alphabetical Order)



**Dr. S. Anandhan Professor & Former Head** Dept. of Metallurgical and Materials Eng. NIT Surathkal, Karnataka, India



**Dr. P. Annadurai Scientist F, Head (Materials Science)** NPOL, DRDO, Thrikkakara, Kerala, India



Dr. Dibyendu Sekhar Bag Scientist-'G'/Additional Director Head, Polymers and Rubber Division DMSRDE (DRDO)



Ms. Geetha AVULA Senior Technical Manager SIMULIA India, Dassault Systemes India Private Limited



**Dr. Narayanan Ramanujam Sr. Technical Manager** Manufacturing Intelligence Division, Hexagon



Dr. Prasenjit Ghosh Deputy Director Hari Sahnkar Singhania Elastomer & Tyre Research Institute (HASETRI) Mysore, India



**Dr. Radek Stocek General Manager** PRL - Polymer Research Lab a subsidiary of Coesfeld GmbH & Co. KG



**Dr. Ramesh Cheerla Research Scientist** Momentive Performance Materials (India) Private Ltd.



**Dr. SABU THOMAS Chairman,(TrEST Research Park)** Former Vice Chancellor, MGU, Kottayam, Kerala



**Dr. Santanu Chattopadhyay Professor** Rubber Technology Centre, Indian Institute of Technology, Kharagpur



Senthil Kumaran Varatharajan Associate Chief Engineer HOD-Materials Technology Mahindra &Mahindra Limited



Sharad Goyal Head - Advanced Engineering CEAT Limited Vadodara, India



Dr. Will Mars President ENDURICA LLC, USA

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**Dr. Ibrahim Kittur Senior Engineer** Design and Development (FEA) GMT Gummi-Metall-Technik GmbH



**Dr. T Jagadish Director - R&D** DHIO Research and Engineering Private Limited, Bangalore India



**Dr. Kasilingam Rajkumar Director** Indian Rubber Materials Research Institute (IRMRI), Thane, India



**Dr. Koji Okuwaki Researcher - Material Science Team** JSOL Corporation, Japan



Dr. Mythravaruni Pullela Assistant Professor Rubber Technology Centre Indian Institute of Technology Kharagpur





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### **Key Presentations**

Development of Duty Cycle for Passenger Electric Vehicles Using RLD Signal and Non-Linear Rubber Characteristics

Mr. Vishwas More | Dr. Sandip Hazra Tata Motors, Pune

Numerical Simulation of Hyperelastic EPDM Seal Performance Under Variable Temperature and Material Conditions for Automotive Applications



Bharath P T, Vipin Das, Ted Zeunik, Venkata Naga Indu Sravani Kota, BorgWarner, India Finite Element Analysis of Adhesive Peel Test in Sterile Dressing 289033

R. Prasanna Venkatesh | R.Loganathan HCL Limited, Chennai

Influence of Temperature on Bush Durability Under Torture Track Testing Conditions



Dr. Sandip Hazra\* & Mr. Arkadip Khan\*\* \*Tata Motors. Ltd. India , \*\*Tata Technologies. Ltd. India

### **Pre-Conference Workshops**

more details on www.2025.rubbercae.com

## *Workshop 1*: Workshop on Hyper Elastic Material Modeling – Theory and Simulations

#### **Broad Spectrum of Topics Covered**

Mechanical Behavior of Elastomers: General Material Behavior, Nonlinear Hyperelastic stress-strain behavior, Mullins effect, Temperature and ageing dependence of material properties, Elasticity and Plasticity Mathematical material Model, Incremental plasticity theory, Yield criterion, Flow rule, Hardening Rule, Kinematic hardening, Isotropic Hardening, Viscoelastic dissipation behavior, Elastomer behavior under Loading-unloading condition, Creep and Relaxation.

Hyper-Elastic Material Model : Ronald Rivlin and Melvin Mooney models, Neo-Hookean and Mooney–Rivlin model, Ogden model and the Arruda Boyce model.

**FEA Analysis** : Modelling, Meshing and Viewing Results. Creating Material Model using Different Hyperelastic Models like Ogden, Neo-Hookean,Arruda Boyce, Yeoh, Mooney-Rivlin and so on. Extracting the Stress – Strain Relationship. 2D & 3D Dimensional Problem.

If time permits, more case studies will be covered,



Dr. T Jagadish Director - R&D DHIO Research and Engineering Private Limited, Bangalore India

Date : 19-May-2025 Time : 10.00 am - 05.00 pm Fee : INR 3000.00 + Tax / Person Venue : Bangalore

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*Workshop 2*: Workshop On Molecular Dynamics & RVE Simulation based Material Characterisation

#### **Broad Spectrum of Topics Covered**

- Introduction to Computational Material Science
- Introduction to Multi-scale Modeling
- Introduction to Material Informatics and Data Science
- Differences between Quantum Mechanics & Classical Mechanics
- MD application to rubber, composites, thermoplastics...
- Material Characterisation and Property Development for Mechanical, Thermal, Optical, Electrical, Rheological, Chemical, Interfacial ..etc
- Introduction to RVE Modeling and Applications
- FAMD (Full Atomistic Molecular Dynamics)
- CGMD (Coarse Graines Molecular Dynamics)
- Interface, phase separation simulation
- Dissipative Particle Dynamics(DPD)
- Rheology simulation
- Multi-phase material simulation
- First-Principles Calculation (DFT)
- Multi-scale coupling Simulation
- Quantitative Structure-Property Relationships(QSPR)

If time permits, more case studies will be covered,

Session Expert



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#### Workshop 3 :

Principles for Simulating Elastomer Durability

#### **Broad Spectrum of Topics Covered**

**Fatigue and Fracture**: Introduction to fatigue, Mechanism of Fatigue, Endurance curve, Factors affecting Fatigue, Fatigue Life Prediction Approaches. Rate laws for both cycle &time dependent crack growth, including threshold effects and ozone attack. Overview of Fracture Mechanics, Crack precursor growth tracking based on Fracture Mechanics, Rainflow Counting on history of the critical plane, Common modes of failure, Energy release rate, Stress Intensity Factors, Fracture Mechanics Approach to Fatigue Design.

**Rubber Durability Simulation** : Calculating Fatigue life and Failure location on the part, Critical Plane Analysis to check every potential crack orientation, Damage Extrapolation for residual life, Self-heating analysis, Co-simulation for Ageing and Cyclic Softening, Fatigue Life prediction of parts subjected to lengthy multi-channel Road Load Signals (RLD).

Session Expert



Dr. Will Mars President ENDURICA LLC, USA

Date : 20-May-2025 Time : 10.00 am - 05.00 pm Fee : INR 3000.00 + Tax / Person Venue : Bangalore

#### Workshop 5: Material Modelling for Tyre Industry

#### **Broad Spectrum of Topics Covered**

- 01. Rubber Compound Behavior : Polymer Chain Conformations/ Crosslinking and Network Formation/Rubber-Filler Interactions
- 02. Tire Tread Wear / Abrasion Mechanisms/Temperature and Wear / Tribological Properties
- 03. Rubber-Carbon Black Interactions : Filler Distribution / Reinforcement Mechanisms
- 04. Tire-Contact Mechanics : Tire-Road Surface Interaction/ Deformation of Tire Materials 05. Thermal Properties and Heat Generation : Heat Build-up in Tire Rubber/Thermal
- Conductivity: 06. Aging and Degradation Mechanisms : Oxidation and UV Degradation/Molecular
- Degradation Pathways 07. Moisture and Chemical Resistance : Hydration Effects/ Chemical Resistance
- 07. Moisture and Chemical Resistance : Hydration Effects/ Chemical Resistance
   08. Advanced Composite Materials for Tires : Carbon Nanotubes and Graphene in Rubber
- /Multi-Phase Material Modeling 09. Nano-Scale Reinforcement in Tires : Nanostructure Design/Molecular Dynamics of
- Nanocomposites 10. Molecular Simulation of Tire Inflation : Gas-Solid Interactions/ Internal Tire Pressure

Dr. Taku Ozawa

Head

- Effects
- Molecular Modeling of Tire Recycling : Recycling of Rubber Waste / Upcycling Techniques

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12. Molecular Simulations of Tire Rolling Resistance : Energy Loss Mechanisms / Optimizing Rubber for Low Rolling Resistance



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**Multiscale Material Simulation** 

JSOL Corporation, Japan

#### Workshop 4: Tyre Durability Simulation - Endurica Workflow

#### **Broad Spectrum of Topics Covered**

Endurica workflows for simulating aspects of tire performance including self-heating, rolling resistance, high-speed, durability, ageing and oxidation

- 1. Intro to the Endurica toolbox
  - a. CL: Infinite life analysis
- b. CL: Safe life analysis c. DT: Damage tolerant analysis
- d. MP: Multiphysics
- e. EIE: Road loads
- 2. Tire Modeling Workflow Basics
- a. 2D Static analysis: Mount, Inflate
   b. 3D Static analysis: Symmetric Model Generation, Symmetric Results Transfer, Footprint
- c. Steady State Rolling: Driving/Braking, Free Rolling, Slip Angle/Lateral Force
- Generation
  3. Infinite Life Workflow
- a. Rubber's fatigue limit
- b. Crack precursors in tires
- c. Critical Plane Analysis for multiaxial loading
- d. Defining Steady State Rolling
- e. Computing Safety Factor with Endurica CL f. Viewing the Safety Factor sphere

Dr. Will Mars

#### **Session Expert**



President ENDURICA LLC, USA

#### 4. Safe Life Workflow

- a. Fracture mechanics: tearing energy and fatigue crack growth
- b. Strain crystallization
  - C. Outputs: Stress-strain, crack growth, Haigh diagrams, Life sphere and crack orientation, strain, stress, energy histories
  - d. Steady state rolling / basic tire durability for a single loading condition
  - e. Lagrange rolling / sidewall lettering under ozone attack
- 5. Incremental Workflow and Damage Tolerance
- a. Specifying a schedule of testing steps
   b. Tracking crack development, residual strength and residual life
- c. Combining transient and steady state load cases: damage during obstacle impacts
- d. Co-simulation and ageing
- 6. Multiphysics workflows
- a. Steady state self-heating and rolling resistance
- b. Transient thermal analysis + thermal runaway c. Coupling structural and thermal analyses

#### d. Oxygen diffusion / reaction

- 7. Road Loads
- a. Building a pre-computed map of tire behavior
- b. Analysis of real-time tire loading
- c. Rainflow counting and identification of mostdamaging events
- Date : 19-May-2025, Time : 10.00 am 05.00 pm Fee : INR 5000.00 + Tax / Person

## *Workshop 6:* Best Practices of Rubber Material Testing for Strength and Durability

#### **Broad Spectrum of Topics Covered**

Learn the essential principles and practices of material characteriza--tion for fatigue life prediction, and strategies and procedures for planning effective fatigue test programs as well as making effective use of crack nucleation and fracture mechanics approaches. Covers static and dynamic stress-strain characterization, strength and fatigue parameters, viscoelasticity and self-heating, strain crystallization, creep, reliability, and ageing.

Learn on how to conduct elastomer testing that includes static and dynamic tests. Static tests measure properties like Elastic Modulus and strength at break by stretching or compressing the specimen. Dynamic tests assess properties such as dynamic modulus and fatigue life under real-world conditions. These tests provide crucial data for engineering design and performance evaluation.

Session Experts Dr. Will Mars President ENDURICA LLC, USA Dr. Radek Stocek General Manager PRL - Polymer Research Lab a subsidiary of Coesfeld GmbH & Co. KG

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Venue : Bangalore

### **About Organisers**



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Virtual Engineering is an online platform that automates the learning of engineering physics and concepts using advanced computational simulation software and technologies.

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DHIO Research & Engineering Pvt Ltd., is a Collaborative Engineering Services and R&D Company based in Bangalore India (www.dhioresearch.com)

DHIO has an experienced pool of experts, engineers and scientists with decades of domain experience and expertise in applying state of the art simulation technology to advanced Computer Aided Engineering Design, Analysis, Life Estimation and Optimisation Knowledge. DHIO Extends its support to Auto, Aero, Power plant, Chemical Processing, Railways and General Engineering Companies to achieve complex engineering simulation needs in product/process/ material design, redesign, engineering, reverse engineering, analysis and optimisation to save money, material and time

#### **Services Offered**

> Structural Evaluation : Design, Analysis, Optimisation, Design Verifications, Validations, Redesign, Re-engineering.

> Fatigue, Durability and Fracture Mechanics : Metal Fatigue, Polymer Fatigue, Load Calculations, Reliability Studies, 3D Crack Growth Analysis, Failure and RLA Studies.

> Computational Fluid Dynamics : 3D CFD, 1D CFD Simulation, System Level Evaluation, Heat Transfer, Mass Transfer, Phase Transfer, Reaction Kinetics, Multiphase, Multiphysics Simulation. > Manufacturing Process Simulations: Casting, Forging, Extrusion, Rolling, PM, Sheet Forming, Heat Treatment Applications, Injection Molding, Composite Modeling and simulation.

> Material Modeling and Characterisation: Atomistic Modeling / DFT/Molecular Dynamics / RVE Modelling Multiscale Modeling.

> **Composite Material** : Material Characterization Product design, Manufacturing Simulation, Failure Studies.

**TechDasoha** is a dynamic platform dedicated to empowering the technical community by organizing and sharing insightful webinars, workshops, and conferences. With the slogan "Sharing Knowledge, Shaping Future," TechDasoha aims to foster collaboration, innovation, and continuous learning, helping individuals and organizations stay ahead in the ever-evolving world of technology. Through its engaging events, TechDasoha nurtures a culture of knowledge exchange, enabling participants to gain valuable skills and shape the future of tech together.

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#### **Diamond Sponsor** INR 4,00,000.00

- TWO Complimentary Registrations
- Full page advertisement in conference program booklet
- Online Visibility Acknowledgement of your company's sponsorship, with your logo and a link to your website.
- Main Screen at keynote Your company logo will be prominently featured on the main screen before keynote speeches.
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### **Platinum Sponsor** INR 3,00,000.00

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#### **Co-ordinators**

#### Ms Shivangi U S

**Product Manager** DHIO Research and Engineering Pvt Ltd., Email:shivangi@dhioresearch.com

#### Mrs. Nethra S

Founder Member - India Science Foundation (ISF) Syndicate Member- Maharani Cluster University (MCU) Director - Virtual Experiential Learning Pvt Ltd., Email:nethra@virtual-engineering.com Phone: +91 9900137005

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#### Enhanced wear resistance of tire Case study courtesy of our sponsorer

J-OCTA, JSOL Corporation, Japan



Failure







Silica

(Left) Overall structure: Interfacial failure between silica aggregates and rubber are shown. And voids are generated in the rubber bulk region. (Middle) Close-up image of a silica aggregate. Rubber molecules can be seen explicitly. (Right) Close-up image of the interface region between silica particle and rubber. [1][2]

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### Amalgamation of Rubber / Elastomer / Polymer Material, Product Testing and Simulation Community



### Here's why you should attend RubberCAE India 2025 ?



International Conference on **Rubber Testing & CAE Simulation** 22nd-23rd May 2025, Bangalore India

### **Registration Form**

Students	Industry Academic	Conference Registration Fee :
		Industry / Govt : <b>INR 5000.00 + Tax</b>
Name		Academic Faculty & Research Scholars : INR 4000.00 + Tax
		Graduate and Masters Students : <b>3000.00 + Tax</b>
Designation		
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