Department of Mechanical Engineering

Guest Lecture Report

FEM in Modern Defense Systems: Fundamentals, Application, and Strategic Relevance

Organized by: Department of Mechanical Engineering, New Horizon College of Engineering.

Date: 17th September 2025

Time: 11:00 AM – 01:00 PM

Venue: Industry 4.0 Lab

Introduction

The Department of Mechanical Engineering at New Horizon College of Engineering organized a guest lecture on "FEM in Modern Defense Systems: Fundamentals, Application and Strategic Relevance." The event was conducted as part of the department's initiative to enhance the technical knowledge of students and bridge the gap between classroom learning and real-world applications. The lecture was arranged for the 7^{th}-semester students to provide them with deeper insights into the significance of Finite Element Method (FEM) in defense technology.

Resource Person

The session was delivered by Mr. Balakumar C, a distinguished scientist from the Gas Turbine Research Establishment (GTRE), DRDO. With a vast experience of 30 years in defense research and applications of FEM in advanced engineering systems, he provided practical insights into its strategic importance in modern-day defense technologies.

Session Highlights

- Fundamentals of FEM
  The lecture began with an introduction to the theoretical basis of FEM, its mathematical framework, and the importance of discretization techniques in solving complex engineering problems.
- Applications in Defense Systems
  Mr. Balakumar elaborated on how FEM is extensively used in the design, testing, and performance evaluation of defense components, particularly in gas turbine systems and aerospace applications. He highlighted real-life case studies that demonstrated how FEM simulations reduce time and cost in defense projects.
- Strategic Relevance
  The resource person emphasized the role of FEM in strengthening national defense capabilities. He explained how simulation-based design enhances reliability, efficiency, and safety of critical defense equipment, thereby contributing to the nation's security preparedness.
- Interaction and Engagement
  Students actively participated by raising questions on the implementation challenges

of FEM in defense applications, software tools used in the industry, and the skillsets required to pursue careers in defense research organizations.

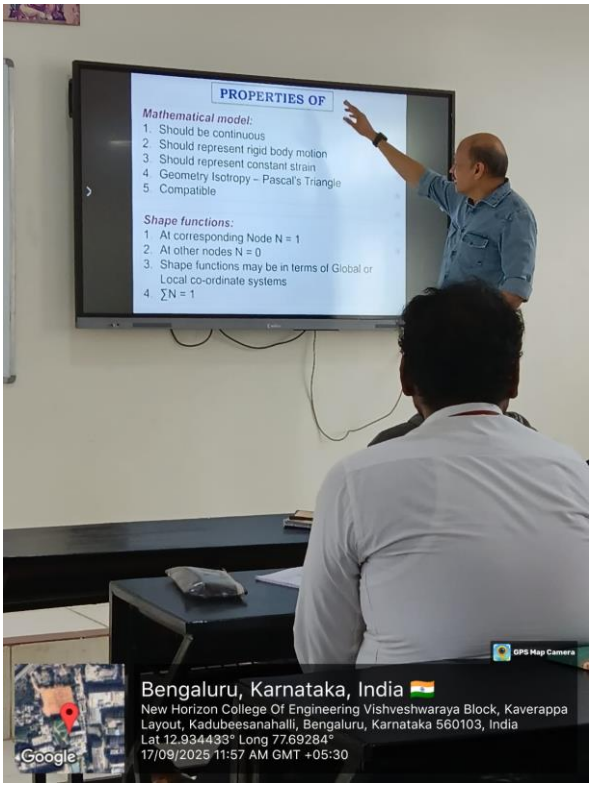
Outcome of the Lecture

The lecture provided students with a conceptual understanding of FEM and its relevance in high-end defense applications. It helped them understand the importance of computational tools in modern engineering and motivated them to explore research opportunities in defense and aerospace sectors. The practical examples shared by Mr. Balakumar enhanced their learning experience and provided valuable career guidance.

Acknowledgement

The department extended its gratitude to Mr. Balakumar C for sharing his expertise, and to Prof. S. Shivaprakash (Senior Assistant Professor – ME), Prof. Rakesh C (HoD – ME), and Dr. Manjunatha (Principal) for their continuous support and encouragement in organizing such knowledge-enriching events.

Photographs from the Event

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FE PROCEDURE
1. Start with Mathematical Model
2. Rewrite the MM in terms of Shape functions
3. Start with Strain
4. Find Strain-Displacement Matrix B
5. Find Stiffness Matrix
6. Find Stiffness matrix for all elements
7. Find force vector for all elements
8. Assemble Element stiffness matrices
9. Assemble element force
10. K.D = F and D = K-1.F with BC. D is
displacement
11. Element wise displacement
12. Find elemental strain ε = B.d
13. Find elemental stress σ = D.e
14. Nodal averaging


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