

A Seminar on

AI-Driven Finite Element Analysis: Unlocking New Possibilities in Engineering

Dr. Pradeep M Solanki
Mechanical Engg.

Activity Report

Academic Year	2024-25
Program Driven by	
Quarter	III
Program / Activity Name	Capacity Building Program
Program Type	
Program Theme	Innovation and startups
Start Date	08-03-2025
End Date	08-03-2025
Duration of the Activity (in Mins)	60
Number of Student Participant	0
Number of Faculty Participant	70
Number of external Participant	--
Expenditure Amount in Rs.	
Any Remark	--
Mode of Session Delivery	Offline
Objective	
Benefit in terms of Learning / Skills / Knowledge obtained	
Feedback	
Video url (mp4)	
Photograph 1 (jpg)	Attached
Photograph 2 (jpg)	Attached
Overall report of the Activity (pdf)	As given below



Dr. P. H. Zope Convener IIC



Title: AI-Driven Finite Element Analysis: Unlocking New Possibilities in Engineering

Speaker: Dr. Pradeep M. Solanki

Date: [08-03-25]

Venue: [SSBT COET Bambhori]

1. Introduction

The seminar on "**AI-Driven Finite Element Analysis (FEA): Unlocking New Possibilities in Engineering**" was delivered by **Dr. Pradeep M. Solanki**, a leading expert in computational mechanics and artificial intelligence applications in engineering design. The seminar focused on how integrating Artificial Intelligence (AI) with Finite Element Analysis is revolutionizing simulation, design optimization, and problem-solving in fields such as mechanical, civil, aerospace, and automotive engineering.

Dr. Solanki provided insights into how AI enhances traditional FEA workflows by reducing computational time, increasing accuracy, and enabling rapid exploration of design alternatives.

2. Objectives of the Seminar

- To introduce the fundamentals of Finite Element Analysis (FEA) and its limitations.
 - To explore how AI technologies can be integrated with FEA tools.
 - To demonstrate real-world applications of AI-enhanced FEA in engineering.
 - To discuss the advantages, challenges, and future prospects of AI-driven FEA.
-

3. Key Highlights of the Seminar

a. Fundamentals of Finite Element Analysis (FEA)

Dr. Solanki began by explaining the basic concept of **Finite Element Analysis**, a numerical method used to predict the behavior of structures and materials under various conditions such as stress, heat, and vibration. Traditional FEA involves meshing the geometry, defining boundary conditions, solving equations, and interpreting results.

While highly accurate, conventional FEA processes can be time-consuming, especially when handling complex geometries, large-scale models, or nonlinear problems.

b. Role of AI in FEA

Dr. Solanki explained how Artificial Intelligence, particularly **Machine Learning (ML)** and **Deep Learning (DL)**, can be used to:

- **Predict simulation outcomes** without fully solving the numerical model.
- **Automate meshing and error estimation**, thereby reducing manual effort.
- **Perform real-time simulations** using surrogate models.
- **Enhance design space exploration** by rapidly evaluating thousands of design variants.

c. Applications of AI-Driven FEA

Dr. Solanki presented several applications where AI is unlocking new possibilities in FEA:

- **Surrogate Modeling (Meta-Modeling):**
Machine learning models are trained using data from FEA simulations to create surrogate models that approximate the behavior of the structure. These are particularly useful for real-time applications and optimization studies.
- **Topology Optimization:**
AI algorithms guide the optimal distribution of material within a structure, helping engineers design lightweight and high-performance components, especially in aerospace and automotive industries.
- **Material Property Prediction:**
AI is used to predict material responses under various loading conditions, minimizing the need for physical testing and speeding up the material selection process.
- **Automated Mesh Generation:**
Deep learning models can generate optimal meshes for complex geometries, ensuring accuracy while minimizing computational cost.
- **Structural Health Monitoring:**
By integrating AI with sensor data, FEA models can be used for predictive maintenance of structures, detecting faults before they lead to failure.

d. Case Studies and Examples

Dr. Solanki shared real-world examples and research case studies:

- **AI-FEA in Automotive Crash Analysis:**
AI accelerates crash simulation by approximating complex nonlinear behavior using neural networks trained on FEA data.
- **AI-Driven Design of Aircraft Components:**
AI-enhanced FEA helps optimize wing structures by reducing weight while maintaining structural integrity, significantly reducing the design cycle.
- **Civil Engineering Applications:**
In structural design and earthquake engineering, AI predicts stress distribution and damage patterns, assisting in safer infrastructure development.

e. Advantages of AI-Enhanced FEA

- **Faster Computation:** Surrogate models reduce simulation time drastically.
- **Higher Productivity:** Engineers can evaluate more design alternatives in less time.
- **Cost Efficiency:** Fewer physical prototypes and tests are required.
- **Automation:** Repetitive tasks like meshing, convergence checking, and result validation can be automated.
- **Real-Time Capabilities:** Enables the use of FEA in real-time control and decision-making systems.

f. Challenges and Limitations

Dr. Solanki also addressed current challenges in AI-driven FEA:

- **Data Requirements:** High-quality, diverse training data is essential for accurate AI models.
- **Generalization:** AI models must be robust and capable of handling unseen geometries or conditions.
- **Integration Complexity:** Combining AI tools with existing FEA software requires technical expertise.
- **Interpretability:** Engineers need trust and transparency in AI predictions, which is a current area of active research.

4. Future Trends in AI-FEA Integration

Dr. Solanki highlighted some emerging trends:

- **Physics-Informed Neural Networks (PINNs):** These AI models incorporate physical laws directly into their learning algorithms, improving accuracy.
- **Digital Twins:** Combining AI with FEA to create real-time, virtual replicas of physical systems for monitoring and prediction.
- **Cloud-Based AI-FEA Platforms:** These platforms offer scalable simulation services, allowing global teams to collaborate and simulate complex systems efficiently.

5. Interactive Session

The seminar included an interactive session where participants asked about:


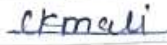

















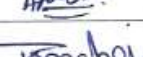
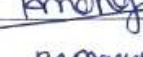
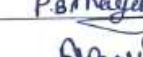

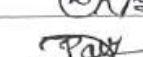

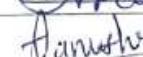
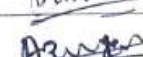
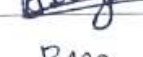


- The reliability of AI predictions compared to traditional FEA results.
- The software tools available for AI-FEA integration.
- How AI could be used in undergraduate engineering projects.

Dr. Solanki emphasized the importance of hybrid models—combining AI with physics-based simulations—to balance accuracy and efficiency. He also mentioned tools like **ANSYS with AI plug-ins**, **COMSOL Multiphysics**, **MATLAB**, and **Python-based ML frameworks** like TensorFlow and PyTorch.

6. Conclusion

The seminar concluded with Dr. Pradeep M. Solanki encouraging engineers and researchers to embrace AI as a complementary tool to traditional simulation techniques. **AI-driven FEA** represents a paradigm shift in engineering analysis, offering a pathway to faster, smarter, and more innovative designs.



Roll no.	Name	Sign
54	Kalyani Bapu pati	
17	Chaitali K. Mali	
60	Megha Manoj Patil	
45	Devayani Samadhan Patil	
74	Shruti Kiran Patil	
73	Shrushti Rakesh Patil	
80	Teena Hemraj Patil	
28	Nizgala Natendra Narkhede	
33	Vishakha Pramod Nikam	
46	Devayani Pravin Patil	
38	Ankita Sanjay Patil	
41	Rutuja Ravindra Patil	
32	Lavanya Santosh Nikam	
83	Pranjal Mukunda Patil	
02	Bhagyashree Anant Khewalkar	
79	Tanvi Vinesh Singh Patil	
70	Ranjana Dnyaneshwar Patil	
19	Prapti Shrawan Mali	
53	Jayshree G. Patil	
08	Bhumiika Dilip Mahajan	
10	Khushi Rajendra Mahajan	
06	Priyanka Bhagwan Magare	
39	Ankita Vilas Patil	
37	Keerti Kaduba Pordeshi	
36	Trupti Dyaneshwar Palve	
55	Khushi Vinayak Patil	
78	Tanushree Pandharinath Patil	
07	Aniket Balwant Mahajan	
05	Prajwal Vinod Machankar	
59	Mayur Sursh Patil	

Sr.No	Name of Student	Sign.	Roll No.
1)	Utkarsha S. Patil	<u>Utkarsha</u>	2
2)	Tanvi Vinod kulkarni	<u>Kulkarni</u>	62
3)	Utkarsha S. Suryawanshi	<u>US</u>	38
4)	Gayatri Tushar Shingate	<u>Shingate</u>	26
5)	Simran Shawata Tadari	<u>Tadari</u>	41
6)	Mansi suresh shirade	<u>Shirade</u>	27
7)	Snigdha Ratilal Patil	<u>Patil</u>	71
8)	Sejal Dipak Sandhanshi	<u>Sandhanshi</u>	21
9)	Pradnya Vijay Nikam	<u>Pradnya</u>	67
10)	Saniya Javed Shaikh	<u>Saniya</u>	74
11)	Gauri Vijay Sonar	<u>Gauri</u>	75
12)	Chhayashree Pralhal Patil	<u>Patil</u>	69
13)	Vaibhavi Vinayak patil	<u>Vaibhavi</u>	3
14)	Troiveni Ashok Solanki	<u>Troiveni</u>	29
15)	Abhijeet. Girish. Patil	<u>Patil</u>	68
16)	Shreyas. Vijay. Sangore	<u>Shreyas</u>	72
17)	Varad Anil Akkavadi	<u>Varad</u>	55
18)	Aryan Kamal Bajaj	<u>Aryan</u>	53
19)	Reham Akiloddin Shaikh	<u>Reham</u>	73
20)	Ganesh P. Sushir	<u>G.P. Sushir</u>	40
21)	Yogeshwar Sapan Wagh	<u>Yogeshwar</u>	51
22)	OM Rajendra Talele	<u>Talele</u>	43
23)	chandheersant Devidas Ahire	<u>Ahire</u>	54
24)	Faigan Lukman Tadvi	<u>Tadvi</u>	79
25)	Kalpesh Ananda Sonawane	<u>Kalpesh</u>	31
26)	Chiranjay Digambar Rajput	<u>Chiranjay</u>	16

Roll No	Name	Sign
23	Aditya Arun more	<u>Aditya</u>
65	Pratik Rajesh Patil	<u>Pratik</u>
66	Prathmesh Avinash Patil	<u>Prathesh</u>
26	Kunal Vasant Nannaware	<u>Kunal</u>
03	Amol Govinda Kumbhar	<u>Amol</u>
04	Ramchandra Bhatu Lohar	<u>Ramchandra</u>
50	Harshal Bharat Patil	<u>Harshal</u>
12	Pranav Bhaskar Mahajan	<u>Pranav</u>
13	Sumit Vinod Mahajan	<u>Sumit</u>

Attendance Sheet

Date and Sign		15/03/25	29/03/25	
SN	Name of faculty Member	Dept.		
1	Dr. P.A. Shirule	Civil		02
2	Dr. F.I. Chavan	Civil		04
3	Dr. Sonali B. Patil	Civil		03
4	Mr. J.N. Kale	Civil		03
5	Ms. Jyoti R. Mali	Civil		05
6	Pankaj Ramdas Punase	Civil		03
7	Ms. Dipika Purushottam Mali	Civil		01
8	Kalyani Ganesh Bendale	Civil		00
9	Dr. K.P. Adhiya	Computer		04
10	Dr. Manoj E Patil	Computer		04
11	Mr. Ashish T. Bhole	Computer		04
12	Dr. Akash D. Waghmare	Computer		06
13	Dr. Dnyaneshwar K. Kirange	Computer		06
14	Dr. Pankaj H. Zope	Computer		03
15	Dr. Surendra P. Ramteke	Computer		06
16	Ms. Shital A. Patil	Computer		03
17	Mr. Sarkarsinha Harshinha Rajput	Computer		05
18	Mr. Mohan Pramod Patil	Computer		05
19	Mr. Ramkrishna Hari Patil	Computer		05
20	Mr. Pramodgiri B. Gosavi	Computer		02
21	Ms. Priyanka Vinod Medhe	Computer		06
22	Mr. Krunal Chadrashekhhar Pawar	Computer		03
23	Ms. Pooja Mukundrao Khandar	Computer		03
24	Ms. Ashwini Arun Kakde	Computer		03
25	Ms. Mayuri Rajesh Chandratre	Computer		04
26	Ms. Shama S Pawar	Computer		03
27	Mr. Mohammed Shafique Shaikh	Computer		05
28	Ms. Tejashri Anil Patil	Computer		—
29	Ms. Prachi Pushkaraj Chaudhari	Computer		—
30	Ms. Utkarsha Prmod Narkhede	Computer		—
31	Ms. Soniya Premraj Chaudhari	Computer		—
32	Ms. Dipali Daulatrao Phadat	Computer		—
33	Mr. V. S. Pawar	Electrical		03
Pranesh S. Sarda		02/12		02

Attendance Sheet

SN	Date and Sign	Name of faculty Member	Dept.	15/03/25	29/03/25	
34		Mr. M. Mujtahid Ansari	Electrical			05
35		Dr. Suhas M. Shembekar	Electrical		—	04
36		Dr. Rajesh R. Karhe	Electrical			04
37		Mr. Muqem Khan	Electrical	—		04
38		Mr. Tanveer Khatik	Electrical		—	04
39		Mr. Vijay Abaji Shinde	Electrical			02
40		Dr. M.P. Deshmukh	E&TC	—		04
41		Dr. V.M. Deshmukh	E&TC			04
42		Dr. N.M. Kazi	E&TC			04
43		Dr. Atul H. Karode	E&TC		—	04
44		Mr. Sunil K. Khode	E&TC		—	03
45		Ms. Rajashri B. Patil	E&TC			05
46		Dr. P.G. Damle	Mechanical		—	04
47		Mr. N. K. Patil	Mechanical	—		04
48		Dr. K. Shrivastav	Mechanical		—	02
49		Dr. Devendra B. Sadaphale	Mechanical			04
50		Dr. P. M. Solanki	Mechanical		—	04
51		Dr. Ajay R. Bhardwaj	Mechanical			03
52		Dr. Dipak C. Talele	Mechanical			05
53		Dr. Vijay R. Diware	Chemical	—		04
54		Dr. S. A. Thakur	Chemical	—	—	03
55		Mr. V. P. Sangore	Chemical	—		04
56		Mrs. Sarika S. Pawar	Chemical		—	03
57		Mrs. Ruchita S. Naik	Chemical		—	04
58		Dr. Sandip S. Patil	First Year			05
59		Dr. K. S. Patil	First Year	—	—	02
60		Dr. Sunita S. Patil	First Year	—		04
61		Dr. Prashant N. Ulhe	First Year			05
62		Mr. Amol Chandrakan Wani	First Year	—	—	03
63		Ms. Priti Ramesh Sharma	First Year		—	02
64		C.U. Nikam	First Year		—	01

Attendance Sheet

Date and Sign		Dept		Signs 29/01/21	
Sl. No.	Name of Faculty Member	Dept	First Year	First Year	Sl. No.
61	Mr. Pratik D. Patel	First Year	P	P	08
62	Mr. Dhanraj S. Doshi	First Year			09
63	Mr. Mahendra S. Patel	First Year			01
64	Mr. Manoj Prasad Kulkarni	First Year			02
65	Mr. Dharmendra Chandikar Vagade	First Year			03
66	Dr. Anand T. Patel	First Year			04
67	Mrs. Nitesh Sawant	First Year			05
68	Mr. Tarun S. Chaudhari	First Year			06
69	Mrs. Anil Dhanraj Patel	First Year			07
70	Mr. Dhanraj S. Vagade	First Year			08
71	Mrs. Poo Manoj Mali	First Year			09
72	Mr. Dhanraj S. Chaudhari	First Year			10
73	Mr. Sachin Tejendra Bhalekar	First Year			11
74	Dr. Mahesh S. Rawlani	MBA			12
75	Dr. Rishi A. Modhwar	MBA			13
76	Mr. Farooq A. Khan	MBA			14
77	Mrs. Bharti F. Joshi	MBA			15
78	Mrs. Sakshi Manoj Modhwar	MBA			16
79	Mr. Rishabh Sunil Patel	MBA			17
80	Mr. Anand Dhanraj Sawant	MBA			18
81	Dr. Pooja Dhanraj Vagade	MBA			19
82	Mr. Tejendra Dhanraj Vagade	MBA			20
83	Mr. Anand Dhanraj	MBA			21
84	Mr. Dhanraj Dhanraj	MBA			22
85	Mr. Dhanraj Dhanraj	MBA			23
86	Mr. Dhanraj Dhanraj	MBA			24
87	Mr. Dhanraj Dhanraj	MBA			25
88	Mr. Dhanraj Dhanraj	MBA			26
89	Mr. Dhanraj Dhanraj	MBA			27
90	Mr. Dhanraj Dhanraj	MBA			28
91	Mr. Dhanraj Dhanraj	MBA			29
92	Mr. Dhanraj Dhanraj	MBA			30
93	Mr. Dhanraj Dhanraj	MBA			31
94	Mr. Dhanraj Dhanraj	MBA			32
95	Mr. Dhanraj Dhanraj	MBA			33
96	Mr. Dhanraj Dhanraj	MBA			34
97	Mr. Dhanraj Dhanraj	MBA			35
98	Mr. Dhanraj Dhanraj	MBA			36
99	Mr. Dhanraj Dhanraj	MBA			37
100	Mr. Dhanraj Dhanraj	MBA			38

Attendance Sheet

SN	Name of faculty Member	Dept.	08/02/25	15/2/25	08/03/25	
1	Dr. P.A. Shirule	Civil				2
2	Dr. F.I. Chavan	Civil				2
3	Dr. Sonali B. Patil	Civil				1
4	Mr. J.N. Kale	Civil				1
5	Ms. Jyoti R. Mali	Civil				3
6	Pankaj Ramdas Punase	Civil				2
7	Ms. Dipika Purushottam Mali	Civil				0
8	Kalyani Ganesh Bendale	Civil				0
9	Dr. K.P. Adhiya	Computer				2
10	Dr. Manoj E. Patil	Computer				2
11	Mr. Ashish T. Bhole	Computer				3
12	Dr. Akash D. Waghmare	Computer				3
13	Dr. Dnyaneshwar K. Kirange	Computer				2
14	Dr. Pankaj H. Zope	Computer				2
15	Dr. Surendra P. Ramteke	Computer				3
16	Ms. Shital A. Patil	Computer				1
17	Mr. Sarkarsinha Harshinha Rajput	Computer				2
18	Mr. Mohan Pramod Patil	Computer				0
19	Mr. Ramkrishna Hari Patil	Computer				3
20	Mr. Pramodgiri B. Gosavi	Computer				
21	Ms. Priyanka Vinod Medhe	Computer				2
22	Mr. Krunal Chadrashankar Pawar	Computer				2
23	Ms. Pooja Mukundrao Khandar	Computer				2
24	Ms. Ashwini Arun Kakde	Computer				2
25	Ms. Mayuri Rajesh Chandratre	Computer				2
26	Ms. Shama S. Pawar	Computer				2
27	Mr. Mohammed Shafique Shaikh	Computer				2
28	Ms. Tejashri Anil Patil	Computer				
29	Ms. Prachi Pushkaraj Chaudhari	Computer				
30	Ms. Utkarsha Prmod Narkhede	Computer				
31	Ms. Soniya Premraj Chaudhari	Computer				
32	Ms. Dipali Daulatrao Phadat	Computer				
33	Mr. V. S. Pawar	Electrical				2

Attendance Sheet

SN	Name of faculty Member	Dept.	08/02/25	15/02/25	08/03/25	
34	Mr. M. Mujtahid Ansari	Electrical				3
35	Dr. Suhas M. Shembekar	Electrical				3
36	Dr. Rajesh R Karhe	Electrical				3
37	Mr. Muqem Khan	Electrical				3
38	Mr. Tanveer Khatik	Electrical				3
39	Mr. Vijay Abaji Shinde	Electrical				3
40	Dr. M.P. Deshmukh	E&TC				3
41	Dr. V.M. Deshmukh	E&TC				2
42	Dr. N.M. Kazi	E&TC				2
43	Dr. Atul H. Karode	E&TC				3
44	Mr. Sunil K. Khode	E&TC				3
45	Ms. Rajashri B Patil	E&TC				3
46	Dr. P.G. Damle	Mechanical				3
47	Mr. N. K. Patil	Mechanical				3
48	Dr. K. Shrivastav	Mechanical				1
49	Dr. Devendra B. Sadaphale	Mechanical				2
50	Dr. P. M. Solanki	Mechanical				3
51	Dr. Ajay R. Bhardwaj	Mechanical				3
52	Dr. Dipak C. Talele	Mechanical				3
53	Dr. Vijay R. Diware	Chemical				3
54	Dr. S. A. Thakur	Chemical				3
55	Mr. V. P. Sangore	Chemical				3
56	Mrs. Sarika S. Pawar	Chemical				3
57	Mrs. Ruchita S. Naik	Chemical				3
58	Dr. Sandip S. Patil	First Year				1
59	Dr. K. S. Patil	First Year				3
60	Dr. Sunita S. Patil	First Year				3
61	Dr. Prashant N. Ulhe	First Year				3
62	Dr. Amol Chandrakan Wani	First Year				3
63	Ms. Priti Ramesh Sharma	First Year				3
64	C.U. Nikam	First Year				1

Attendance Sheet

SN	Date and Sign	Dept.	08/02/25	15/2/2025	08/03/25	
65	Mr. Pravin D. Patil	First Year	P	P	—	2
66	Ms. Deepmala I. Desai	First Year	Desai	Desai	Desai	6
67	Mr. Mahendra B. Patil	First Year	—	—	—	0
68	Ms. Meera Prassan Kulkarni	First Year	Yashwanth	—	Yashwanth	6
69	Ms. Dhanashree Shashikant Tayade	First Year	D.	—	D.	2
70	Ujawalsing T. Patil	First Year	Patil	Patil	—	2
71	Mrs. Nancy Sawhney	First Year	—	—	—	1
72	Ms. Tanuja Y. Chouhan	First Year	—	—	Tanuja	1
73	Mrs. Anjali Darshan Patil	First Year	—	—	—	0
74	Ms. Jayashree R. Tayade	First Year	R. Tayade	R. Tayade	R. Tayade	3
75	Mrs. Puja Mayur Malu	First Year	—	Malu	Malu	2
76	Mr. Dashrath U. Chaudhari	First Year	Dashrath	—	Dashrath	2
77	Mr. Sachin Topalu Bhalerao	First Year	Sachin	Sachin	Sachin	6
78	Dr. Mahesh V. Rawlani	MBA	—	—	—	1
79	Dr. Richa A. Modiyani	MBA	—	—	—	2
80	Ms. Farooz A. Kazi	MBA	—	—	—	2
81	Mrs. Bharti P. Joshi	MBA	B. Joshi	B. Joshi	B. Joshi	3
82	Mrs. Sakina Mujahid Husain	MBA	Sakina	Sakina	Sakina	3
83	Mr. Rohan Suresh Patil	MBA	—	R. Patil	R. Patil	2
84	Ms. Vrushi Dinkar Sonawane	MBA	V.S.	V.S.	—	2
85	Dr. Puri Dinesh Dagadu	MCA	D. Dagadu	D. Dagadu	D. Dagadu	2
86	Ms. Sapana Ananrao Fegade	MCA	Sapana	Sapana	—	2
87	Mr. Aslan Shaikh	MCA	Aslan	Aslan	—	2
88	Ms. Dhanshee Rajendra Shinde	MCA	—	—	—	0
89	Ms. Chetana Mohan Kawale	MCA	C. Kawale	C. Kawale	C. Kawale	2
90	Ms. Vishakha Yadonao Pande	MCA	V. Pande	V. Pande	V. Pande	2
91	Ms. Bhagyashri Suresh Patil	MCA	—	—	B. Patil	1
92	Ms. Reeta Vinod Patil	MCA	R. Patil	R. Patil	R. Patil	2
93	Dr. Sudhir S. Patil	Library	S. Patil	S. Patil	—	2
94	Nikita Gokul Patil	civil	—	N. Patil	N. Patil	2
95	V. S. Pawan	steriod	P. Pawan	P. Pawan	P. Pawan	2
96	Aravesh Sonawane	civil	—	—	—	0