Bharati Vidyapeeth
(Deemed to be University)
College of Engineering, Pune-43
Department of E&TC Engineering

Report on Technical Training Program

Date: 05/04/2021

Department of Electronics & Telecommunication organized a technical training program cum workshop for students on "Simulation on Nano-Photonic Devices and Phenomenon using Ansys Lumerical". Two days workshop was conducted by Mr.Ankush Sharma, with Masters in photonic, and designation Application Engineer, at CADFEM & ANSYS. Workshop was held on 2nd & 3rd of April, 2021. 48 students attended workshop.

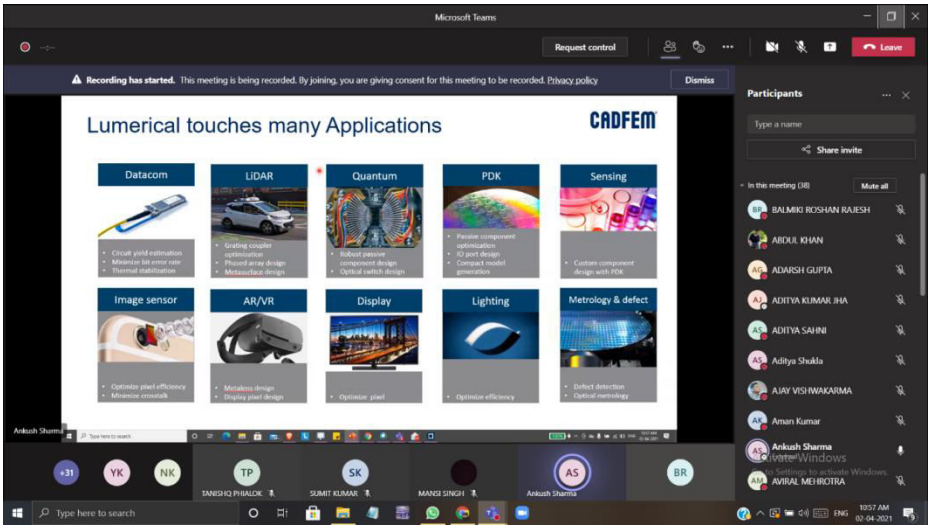
Day 01:

- **Introduction to Photonic:**
  Photonics come from photon which is the smallest unit of light as electron for electricity.
  It is generation, process and manipulation of photons to achieve certain functions.
  In this field you will come up with terms like Optics, Electro-optics, Opto-electronics etc., all these fields are a part of photonics.

- **The FTDT Method:**
  Finite-difference time-domain or Yee's method is a numerical analysis technique used for modelling computational electrodynamics. Since it is a time-domain method, FDTD solutions can cover a wide frequency range with a single simulation run, and treat nonlinear material properties in a natural way.
  FDTD is a versatile modelling technique used to solve **Maxwell's equations**. It is intuitive, so users can easily understand how to use it and know what to expect from a given model.

- **Advantages of FTDT Method:**
  1. General and versatile, no assumption about geometry or direction of light propagation.
  2. Accurate, only approximation is the finite-sized mesh and finite-sized time step.
  3. Broadband, as a time domain method, one stimulation gives broadband result.
  4. Fast, the FDTD algorithm scales well with parallelization, so it is well suited to morden, multi-core and multi-processor computers
  5. High performance computing clusters.

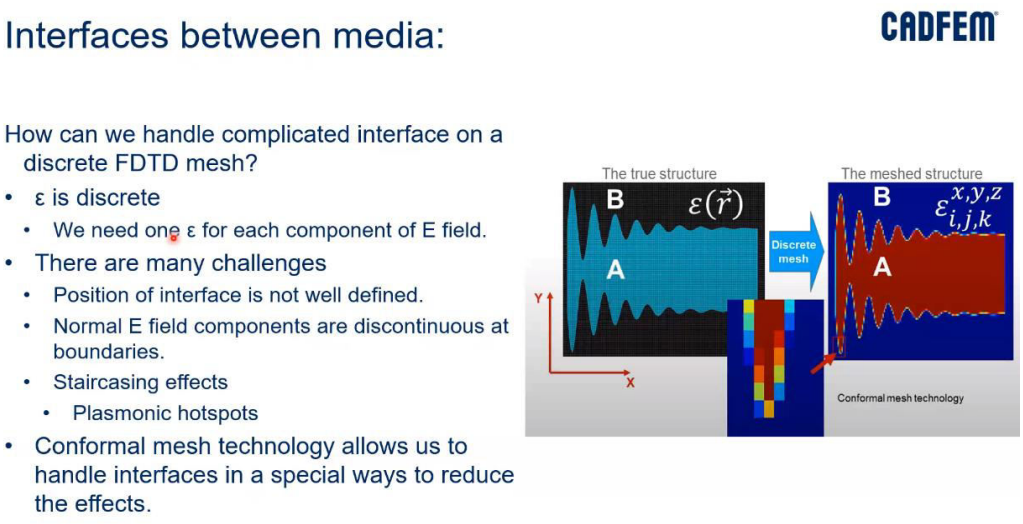
- **Application of FDTD:**



- **THE Spatial Mesh:**
  The stimulation geometry is divided up intoyee cells, the fundamental unit cell of FDTD method.

- **The YEE Cell:**
  The E and H component are staggered in space over Yee cell. The particular location of E and H are ideal for calculating the spatial derivative at the correct location. This allows us to prevent second order accuracy in space on a uniform mesh.

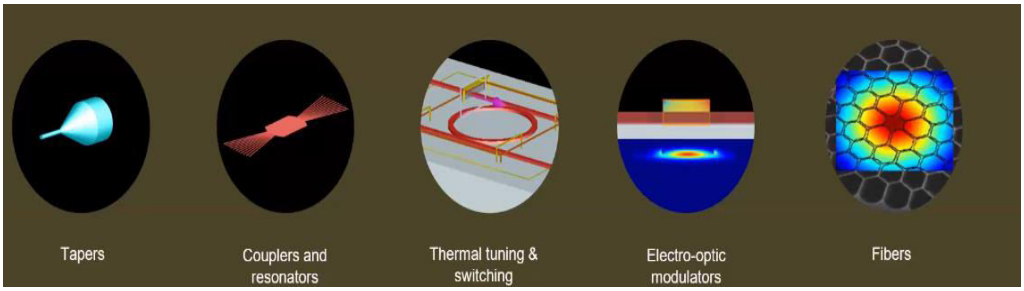
- **Interface between media:**



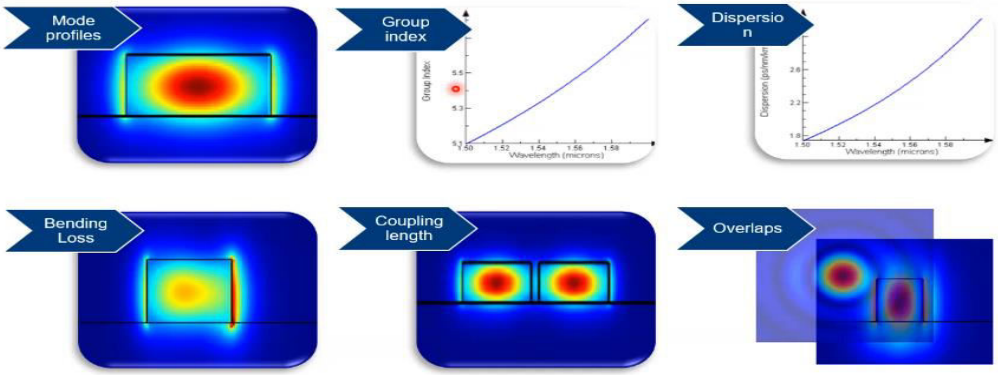
Day 02:

- **AnsysLumerical mode:**
  Whether you are working on fibre optics or integrated photonics, MODE solution has everything you need to get the most out of your waveguide and coupler designs. The bidirectional eigenmodeexpansion and varFTDT easily handle both large planar structure and long propagation length, providing accurate spatial field model frequency and overlap analysis.

- **Key applications:**



- **Finite difference Eigenmode solver: waveguides**



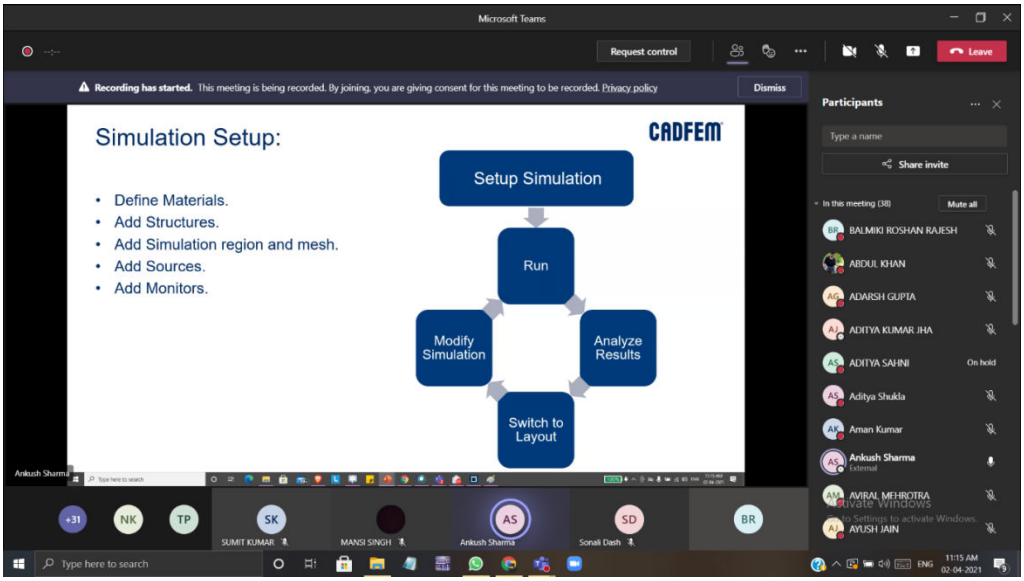
- **Non-linear stimulation methodology:**

Source	Monitors	Simulations
• Precise pulse shape is very important. • Often necessary to adjust source amplitude to required values to create non linear effects.	• Recording data outside the spectrum. • Necessary to adjust the sampling rate of time or frequency monitor.	• Simulation bandwidth override. • Careful while using Bloch boundary conditions. • Convergence and stability.

DETAIL ABOUT THE STIMULATOR USED:

- **Why stimulate?**
  Motivation for stimulation is it is faster and cheaper than prototyping a large number of design verify experimental results.

- **Steps for stimulation:**



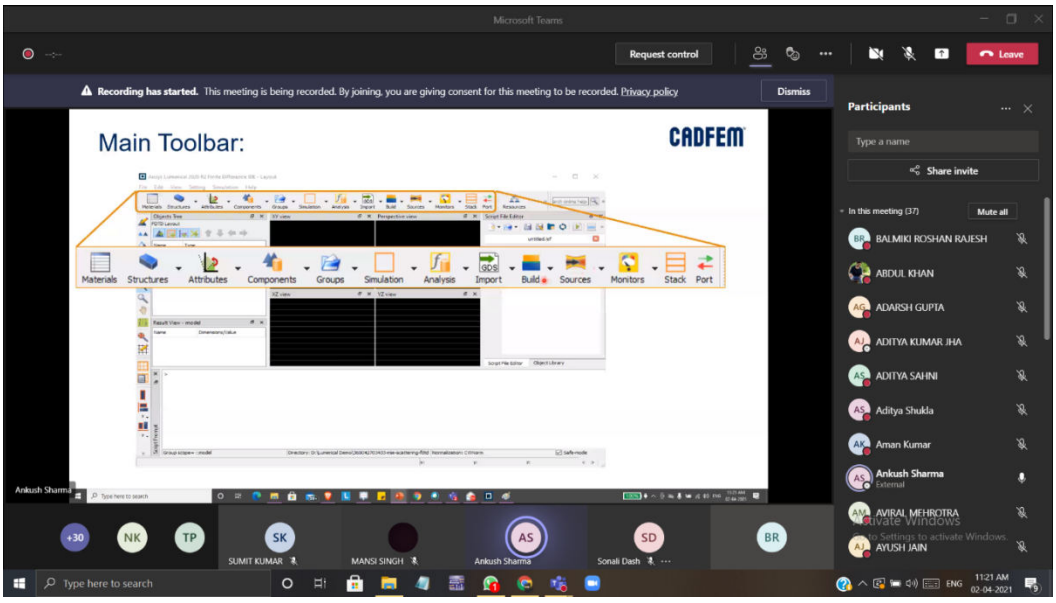
- **About the software:**

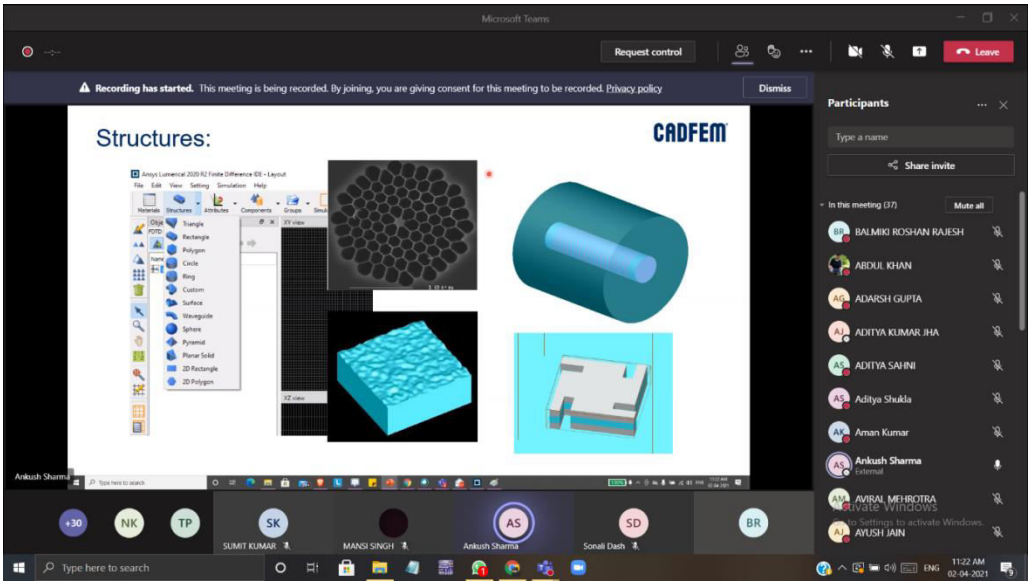
Ansyslumerical

Lumerical's tools enable the design of photonic components, circuits, and systems

Lumerical's DEVICE Suite of component-level simulation products use multiphysics-style simulation workflows to model optical, electrical and thermal effects at the physical level. Lumerical's SYSTEM Suite of system-level simulation products offer a rich set of analysis capabilities to design and optimize the performance of photonic integrated circuits

- **Tools in the software:**

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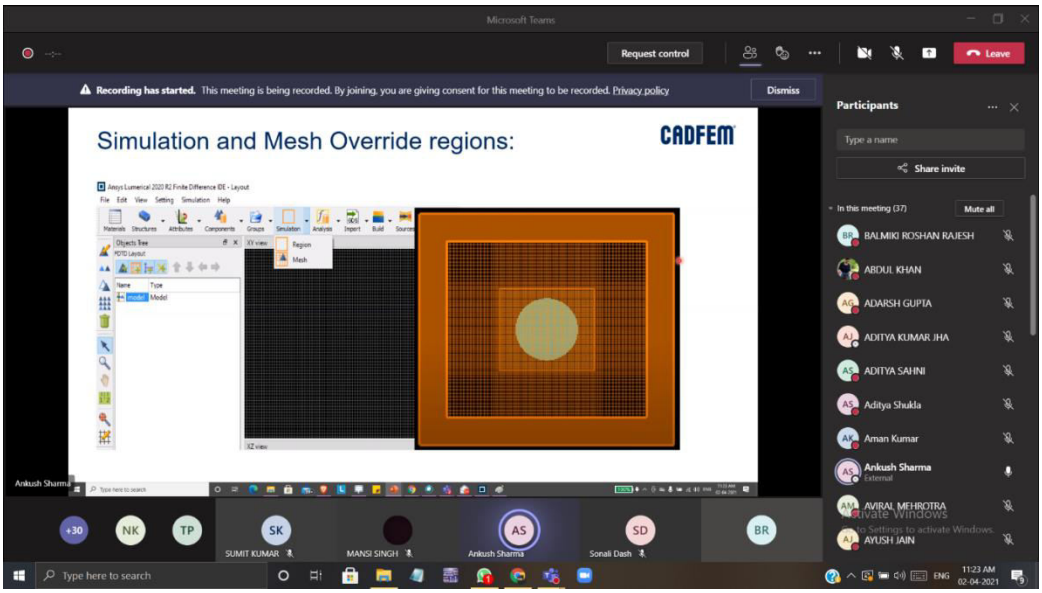
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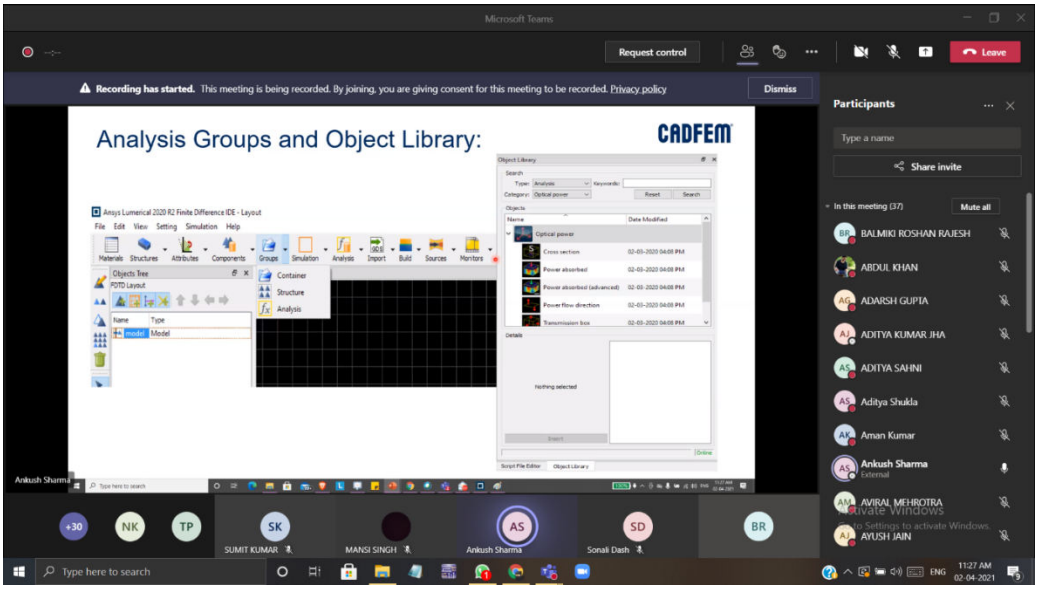
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OBJECTIVE OF THE WORKSHOP:

- The main objective of this workshop was to learn a research-based topic called as photonic and gaining more knowledge about such an unexplored subject.
- To practice practical based on stimulator.
- Exploring wonderful opportunities for learning and internships.

CONCLUSION:

- The workshop gave us a brief information about various aspects of photonics, as well as about the opration of the stimulator lumerical.
- In a book we only acquire theoretical knowledge but in actual the parametric implementation of the same can be grasped by using the stimulator.