Computational Electromagentics and Applications
Professor Krish Sankaran
Indian Institute of Technology Bombay
Summary of Week 11

This week is one of the most interesting week in this entire Course work .

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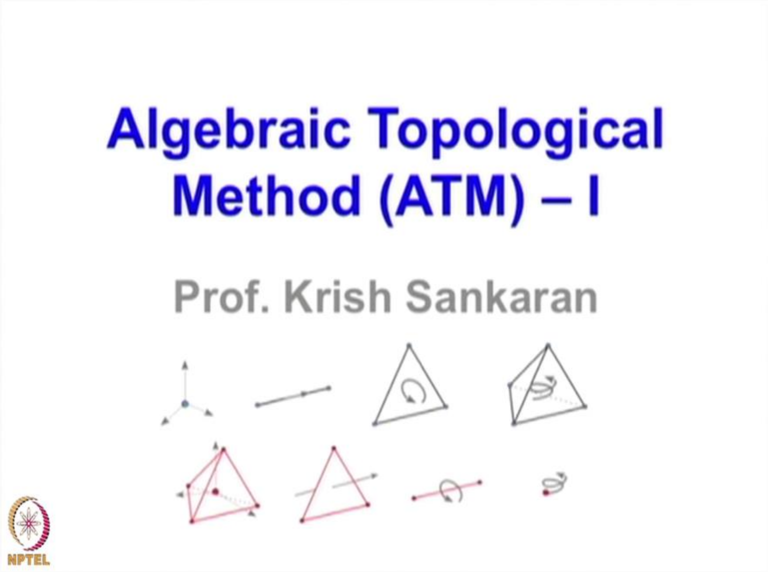

We will be introducing a very unique method which is completely different with the earlier methods we have discussed in this lecture.

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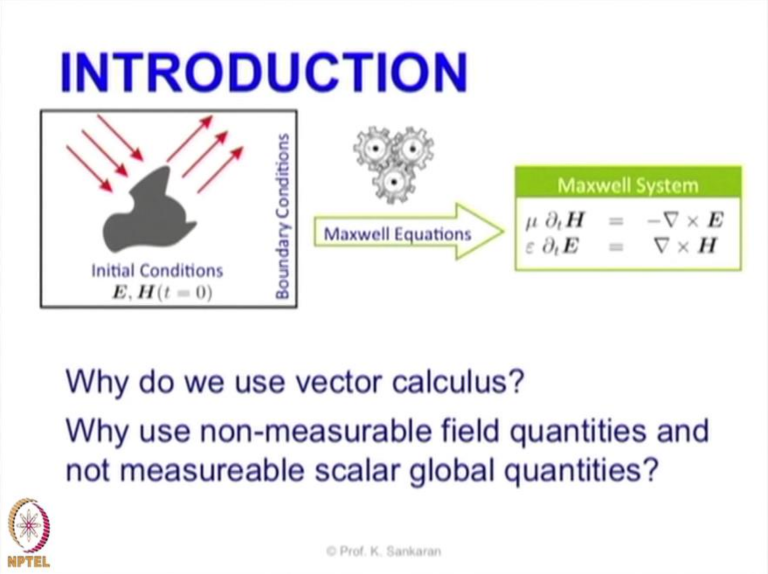

We started this week with a very proactive question about the need for using vector calculus and differential equations in modelling any electromagnetic problem we have been taught since school and college base that electromagnetic problems start with the vectorial description of electric and magnetic base described by the Maxwell partial differential equation.

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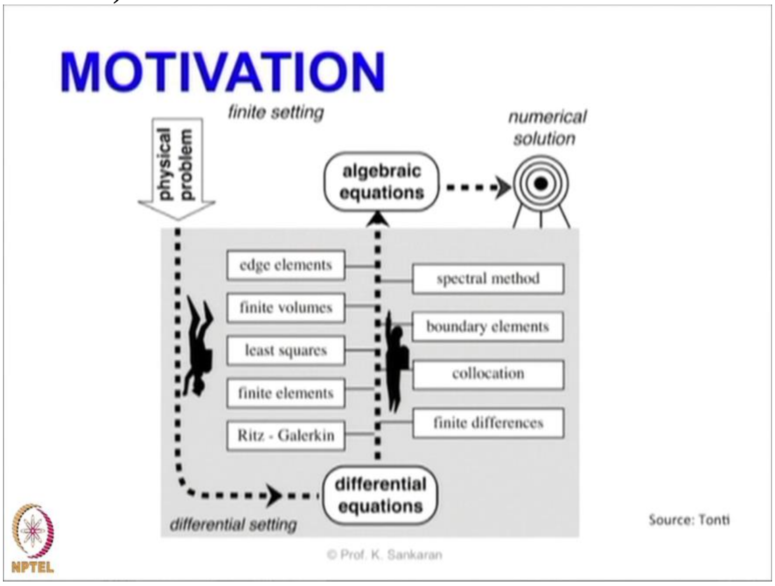

We showed how and why this is a roundabout day for modelling any physical phenomena in particular electromagnetic problems.

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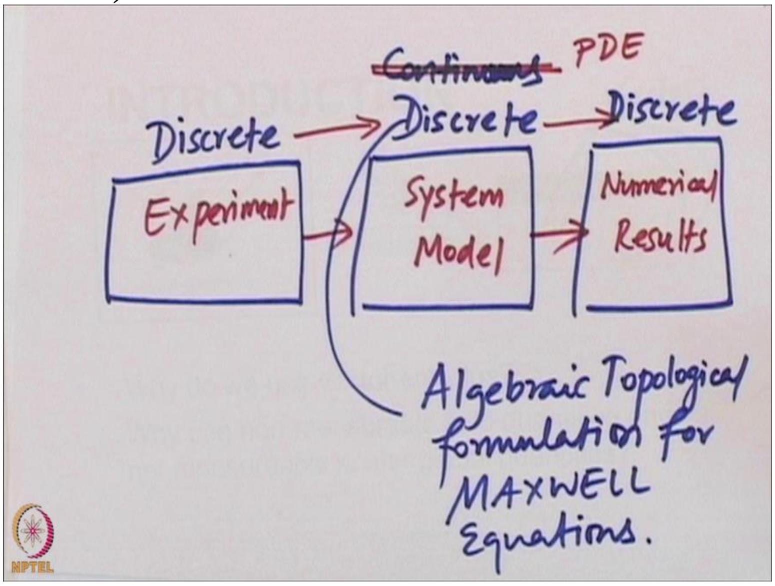

We discussed how one can model electromagnetic problems without the need of differential equations and explain our approach involving discrete algebraic formulation instead of continuous differential formulation.

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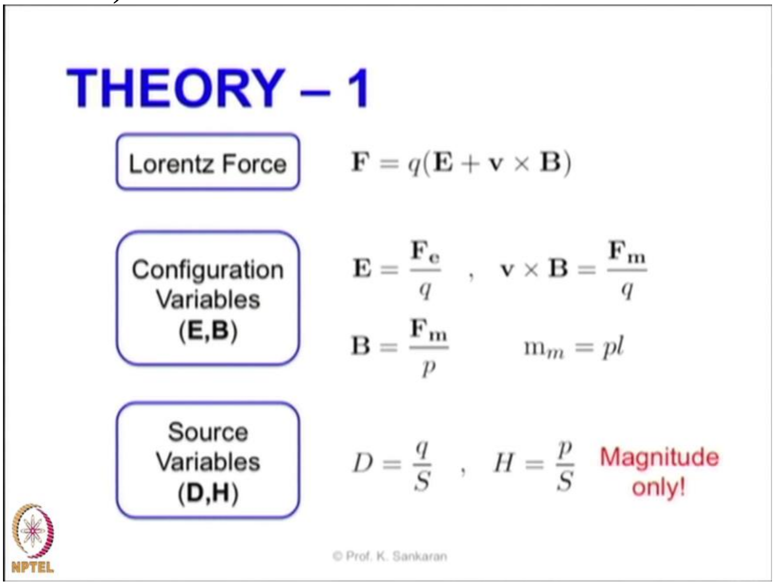

We introduced the theory of algebraic topological method starting with the Lorentz Force equation and we define the configuration and source variables involved in electromagnetic problems.

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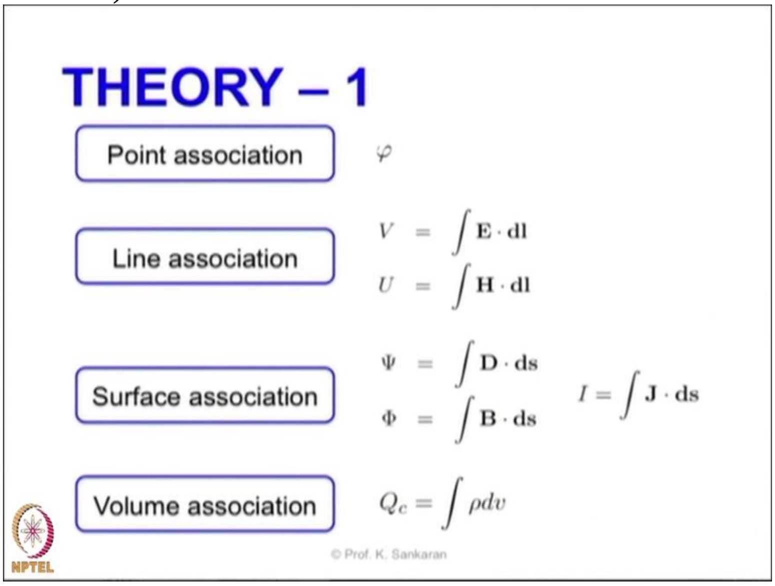

We also discussed how these Global variables are related to certain topological entities such as points lines surfaces and volumes.

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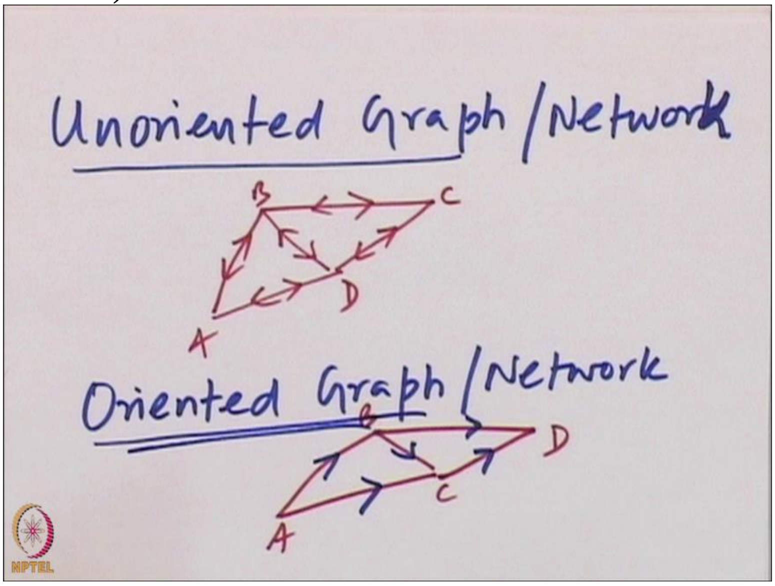

Using a simple electrical circuits we introduced the concept of oriented and an oriented graphs or networks.

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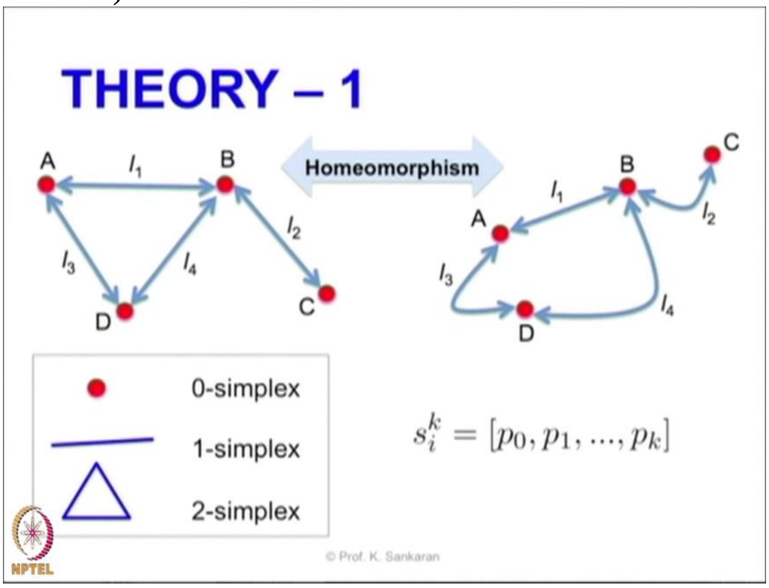

We explained the basic notion of homeomorphism which is normally seen in algebraic topological models we also introduced using examples basic terminologies such as 0 1 2 and 3 simplexes.

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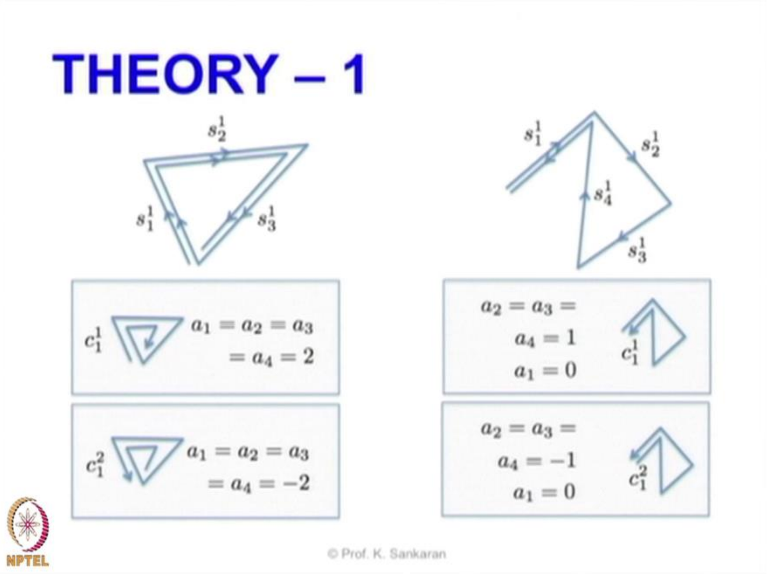

And respective 0 1 2 and 3 chains.

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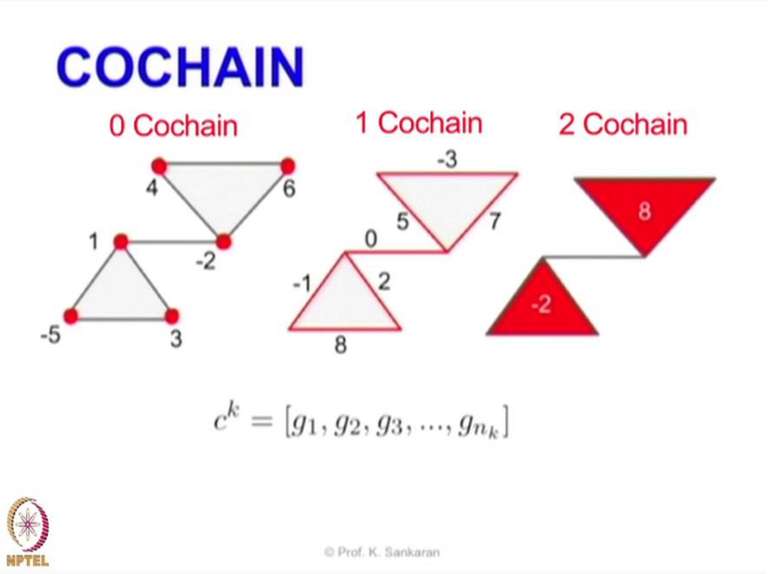

Building on these basics we introduced advanced concepts of co chains.

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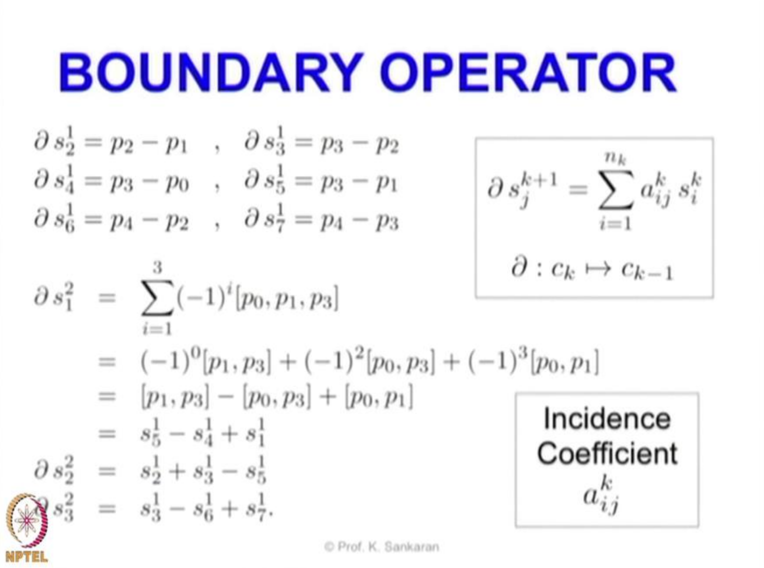

And also the most important operators in algebraic topology namely the boundary and core boundary operators.

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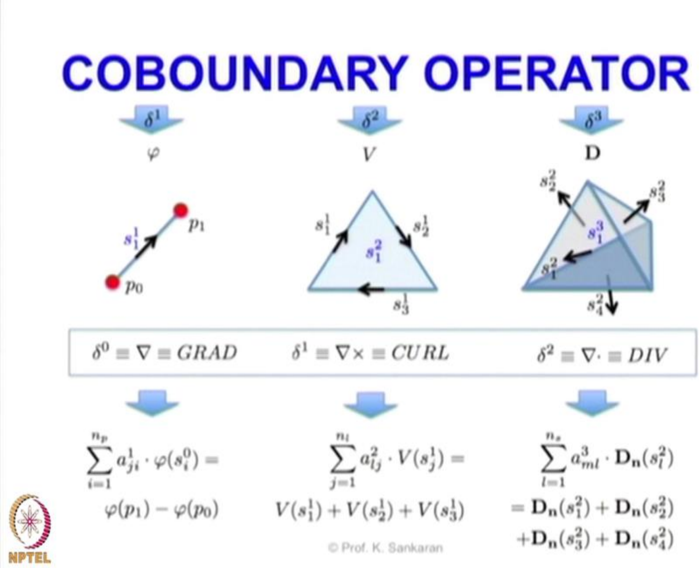

We explain the parallel connections existing between the core boundary operators operating on different co change and the vector calculus operators namely divergence curl and gradient these relationships are the most important connections for modelling physical problems using algebraic topology without the need for vector calculus.

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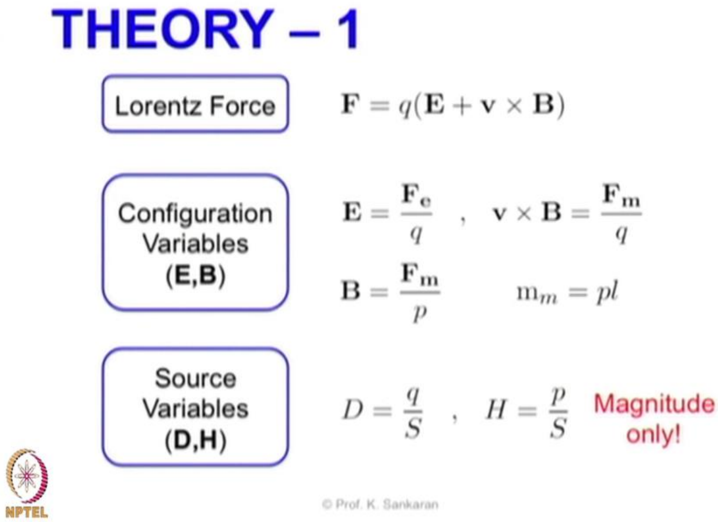

Please carefully go through the concepts and examples that we have discussed in this week.

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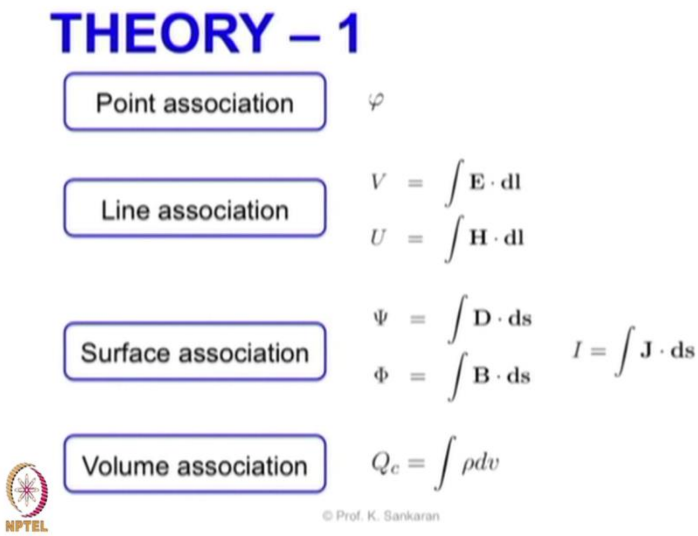

This is one of the Unique opportunities for you to learn and master advanced methods such as algebraic topology.

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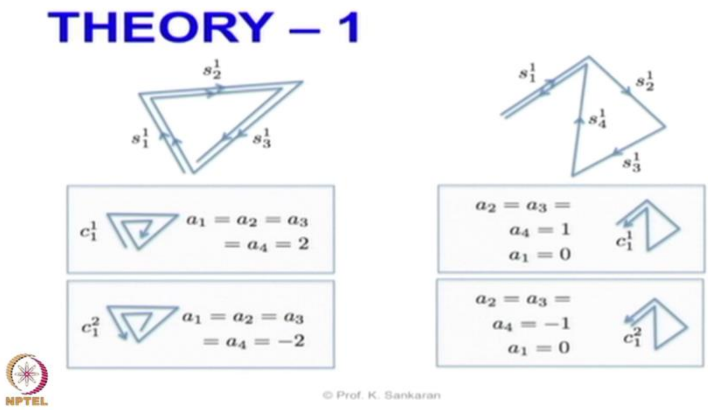

The method of algebraic topology is normally couched in complex terminologies.

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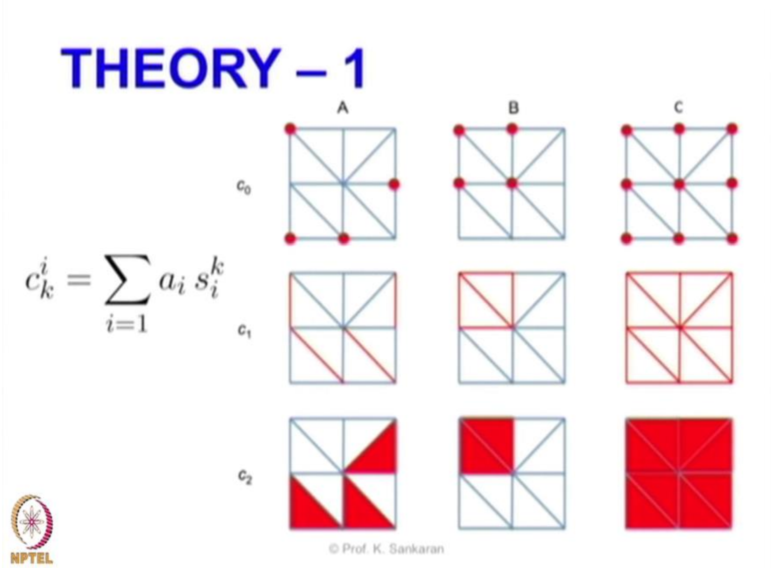

And hence it is always been a distant method do engineers and applied thysicist.

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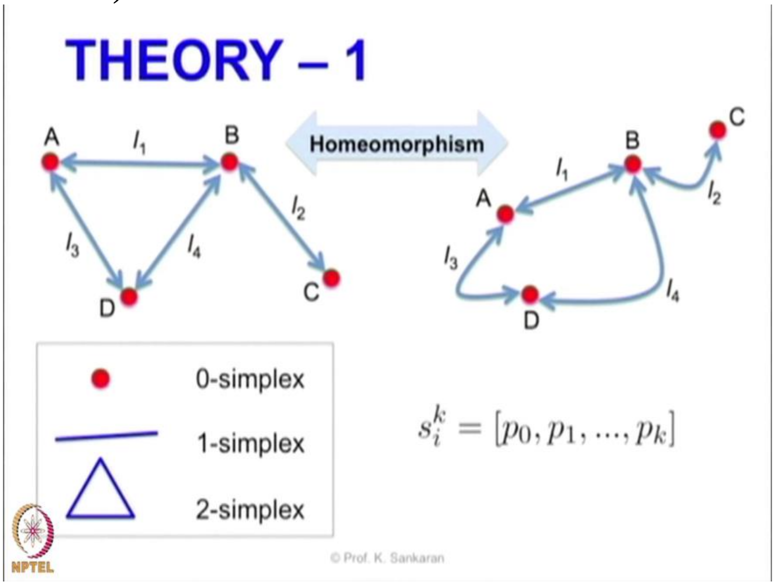

We have tried our best to reduce this complexity.

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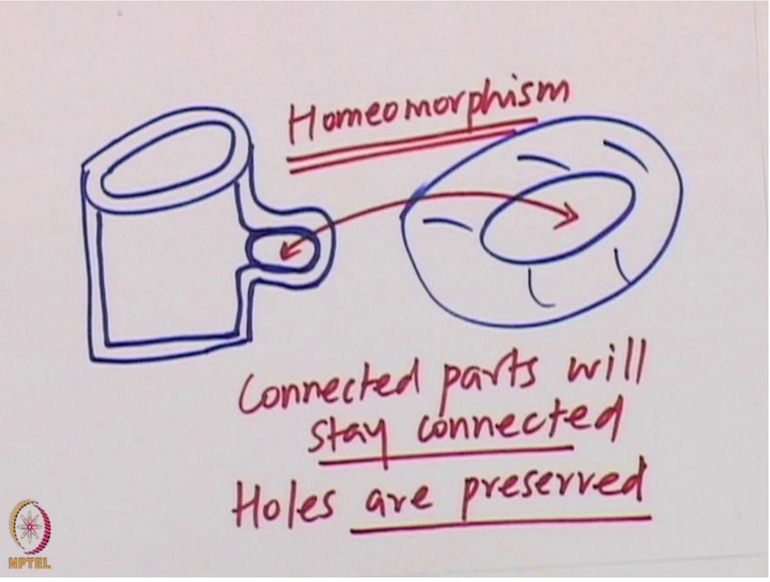

By giving simple examples to explain Complex terms please post your questions in the forum clarify your doubts about the terms and terminologies that we have used in this lecture and get ready for the next week until then goodbye.