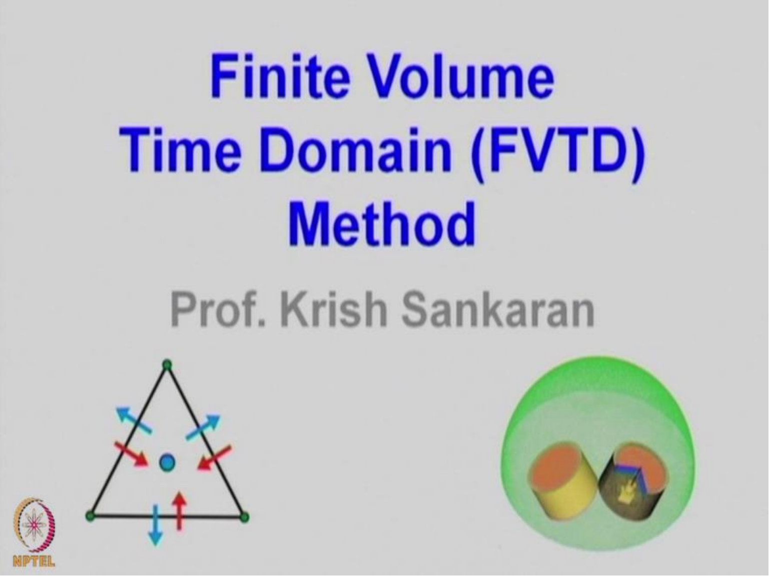
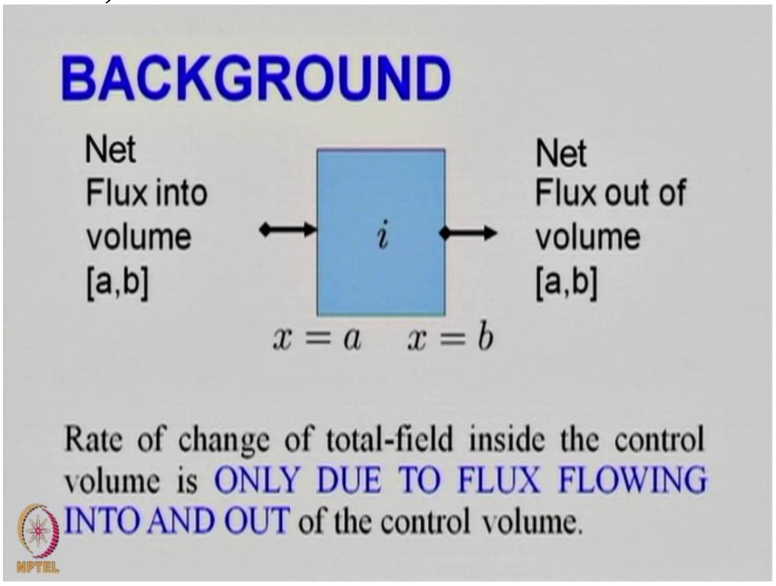
Computational Electromagnetics and Applications
Professor Krish Sankaran
Indian Institute of Technology Bombay
Summary of Week 09

(Refer Slide Time: 00:10)



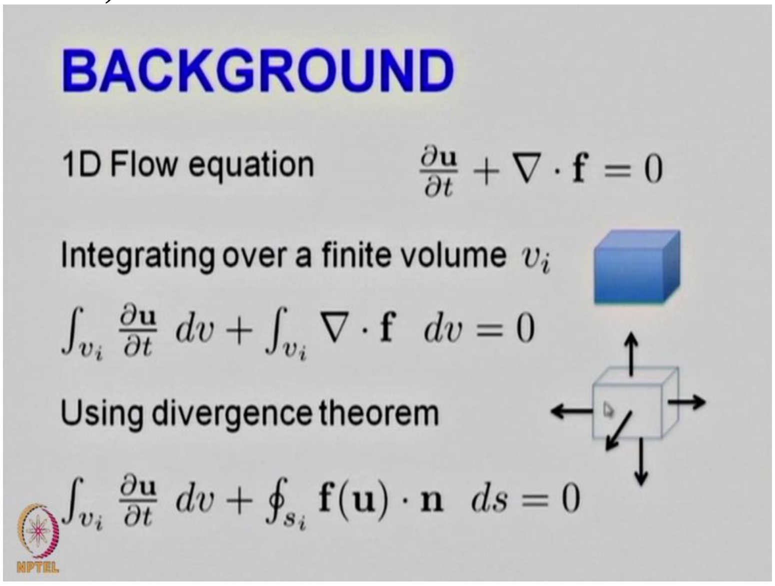
This week we introduced one of the alternative methods for modelling electromagnetic problems namely the finite volume time domain methods

(Refer Slide Time: 00:25)



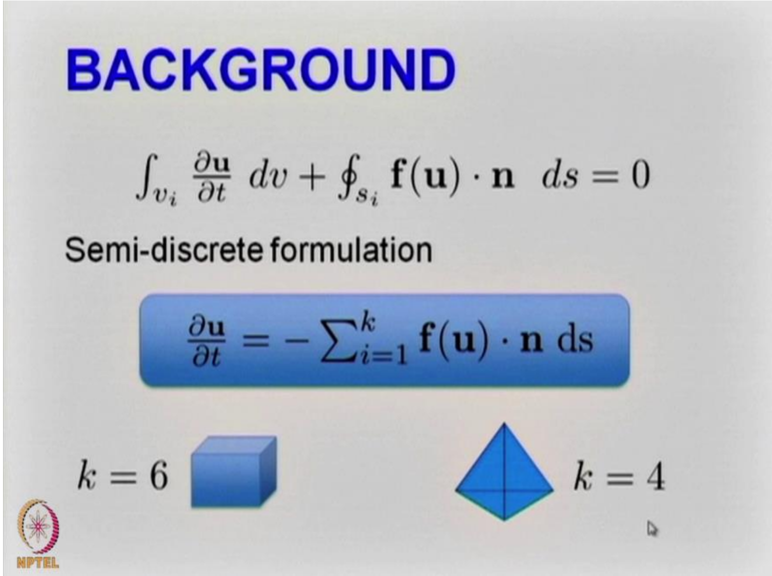
We started with the technical background of this method setting the bases for Finite Volume formulation

(Refer Slide Time: 00:30)



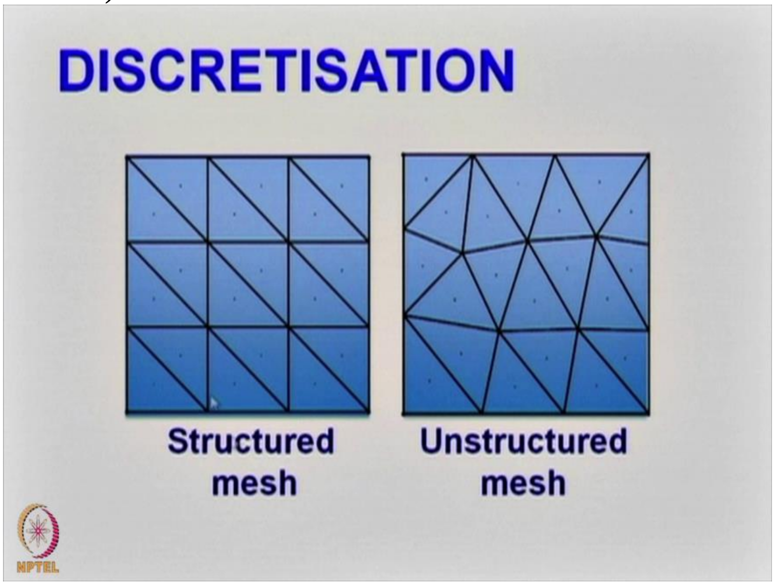
To solve a simple advection equation.

(Refer Slide Time: 00:33)



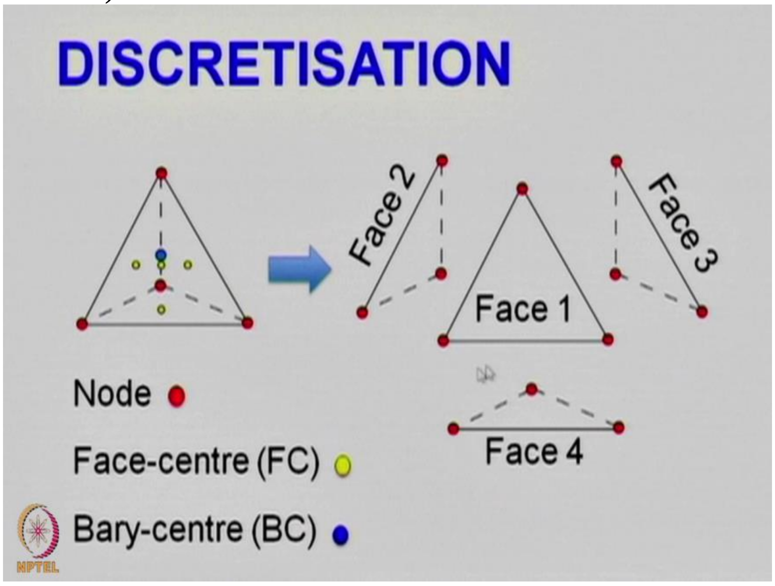
Later on we modelled the one dimensional flow equation using finite volume method.

(Refer Slide Time: 00:42)



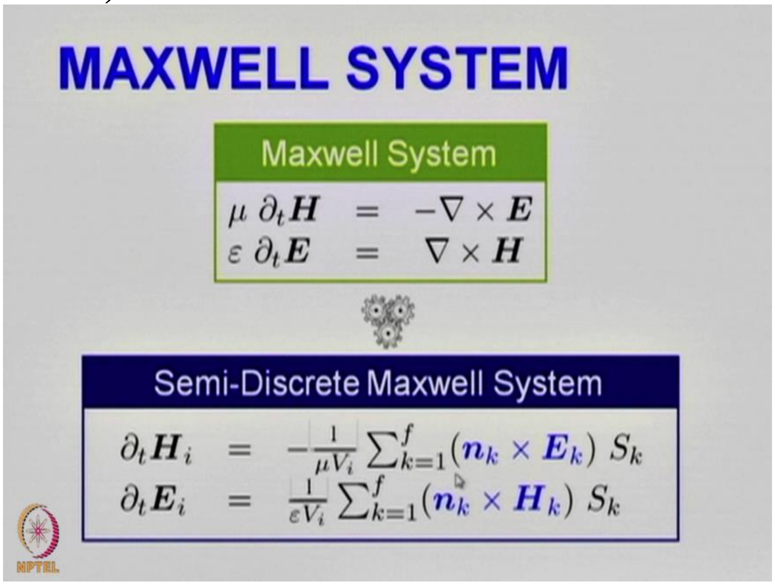
We discussed how the spatial discretisation is carried out

(Refer Slide Time: 00:45)



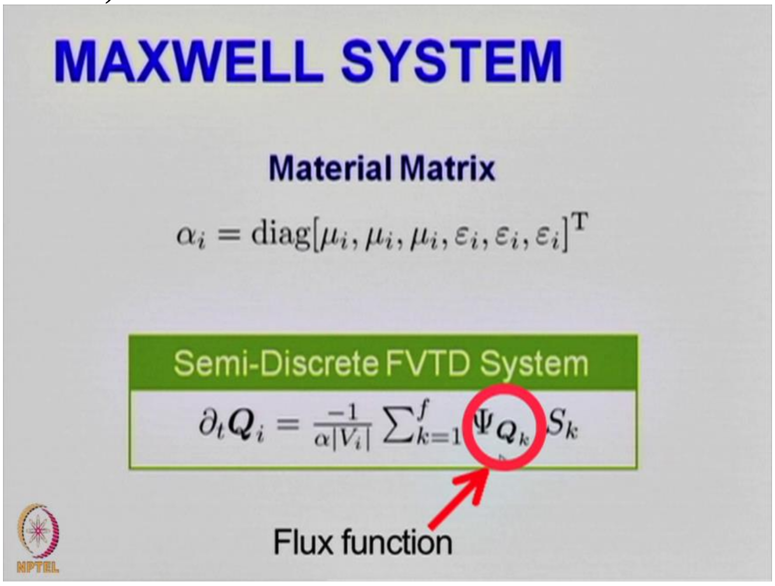
In the finite volume frame work

(Refer Slide Time: 00:51)



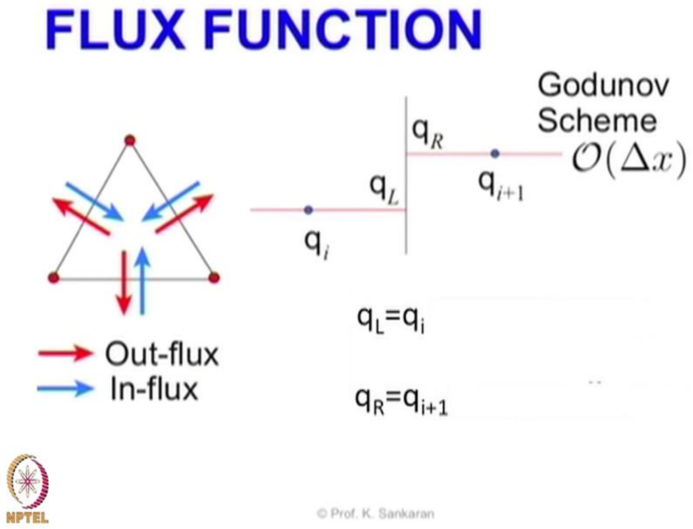
Particularly for the case of Maxwell equations

(Refer Slide Time: 00:53)



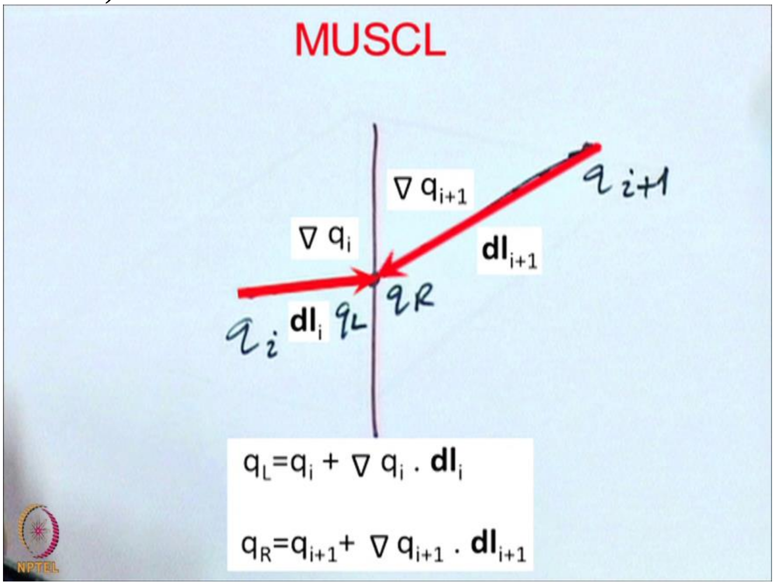
We emphasized the role of flux function in the finite volume frame work and discussed various approaches to compute the flux function.

(Refer Slide Time: 01:04)



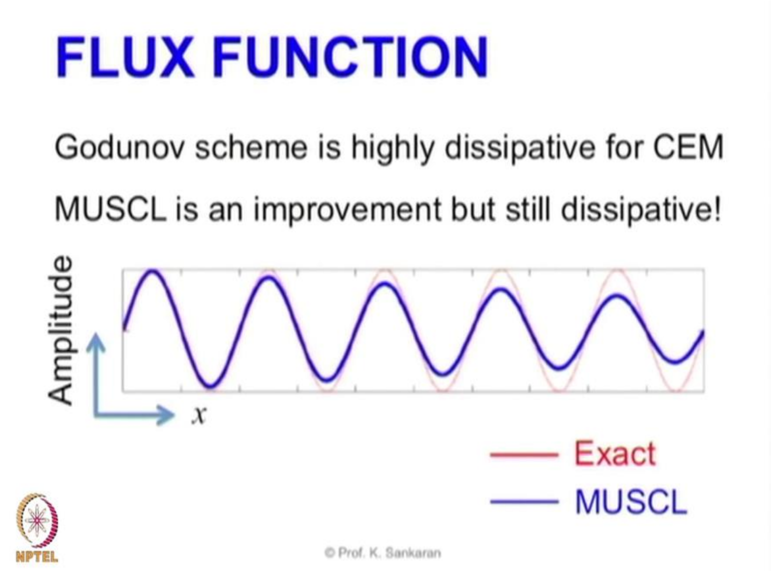
This includes the famous Godunov approach

(Refer Slide Time: 01:10)



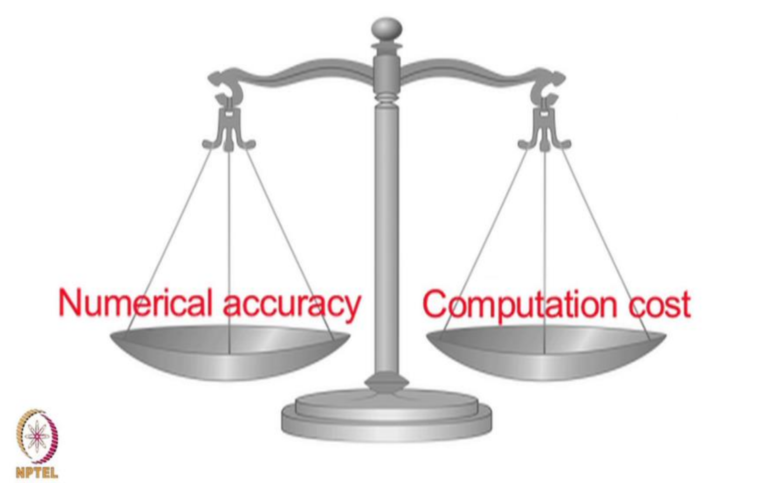
And the monotone upwind scheme for conservation laws shortlu abbreviated as MUSCL algorithm for the Finite volume method

(Refer Slide Time: 01:22)



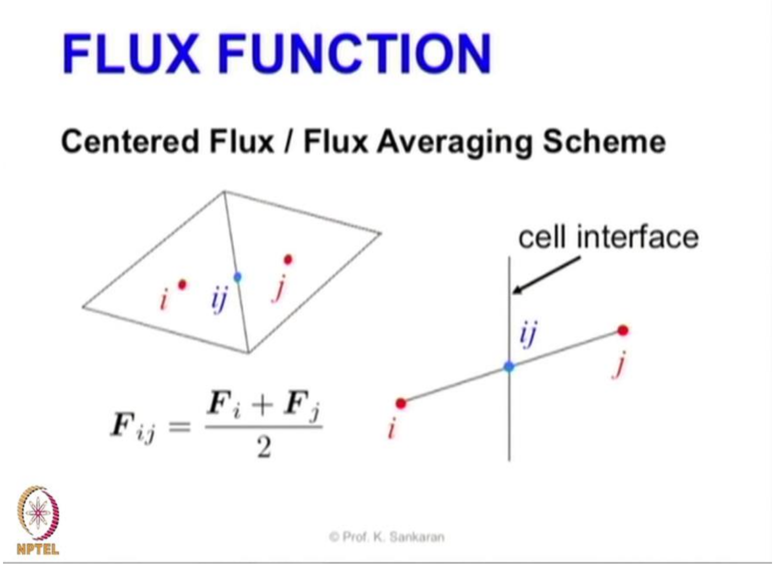
We remark the pros and cons for these approaches

(Refer Slide Time: 01:26)



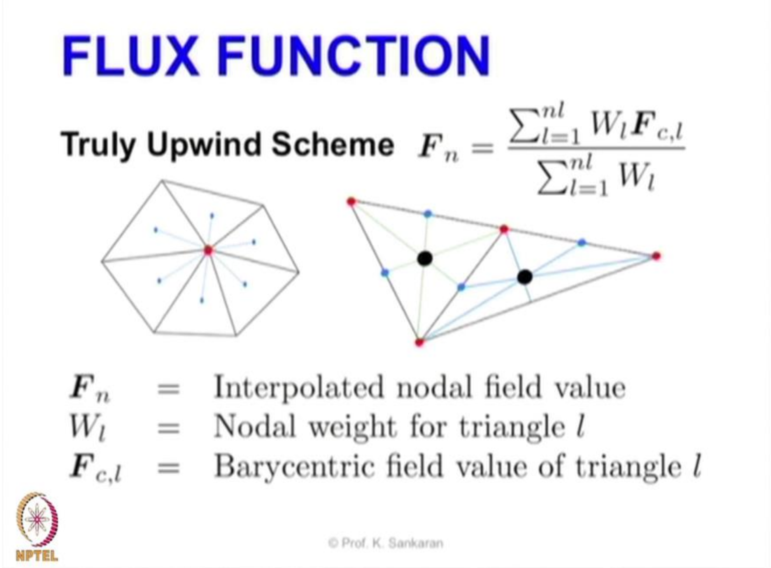
Particularly emphasizing their computational cost and accuracy

(Refer Slide Time: 01:30)



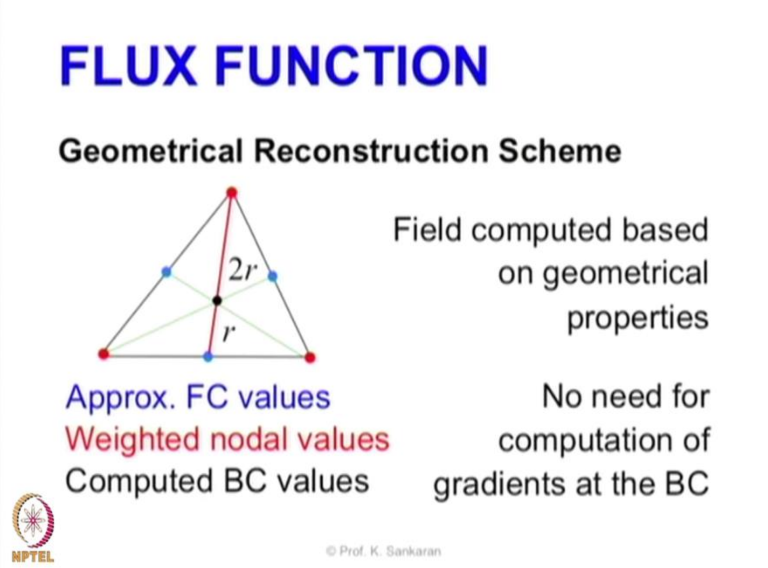
We later introduced the centred flux averaging scheme

(Refer Slide Time: 01:34)



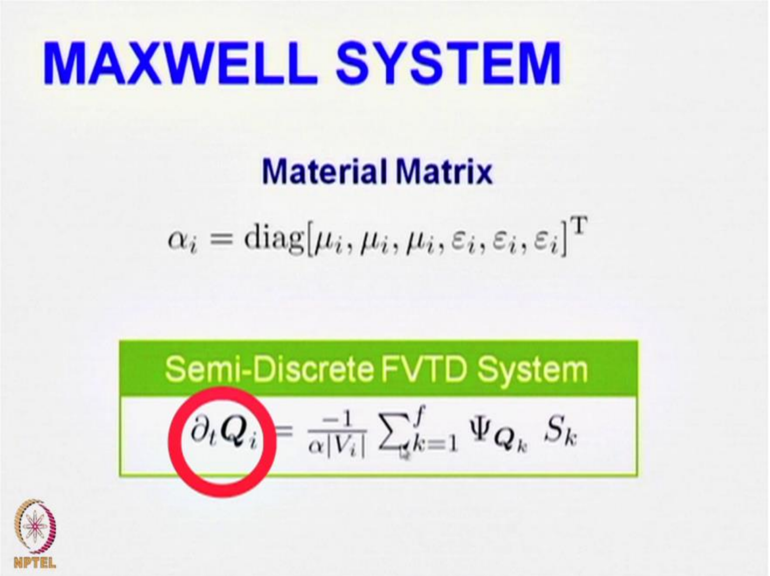
Truly upwind scheme and

(Refer Slide Time: 01:38)



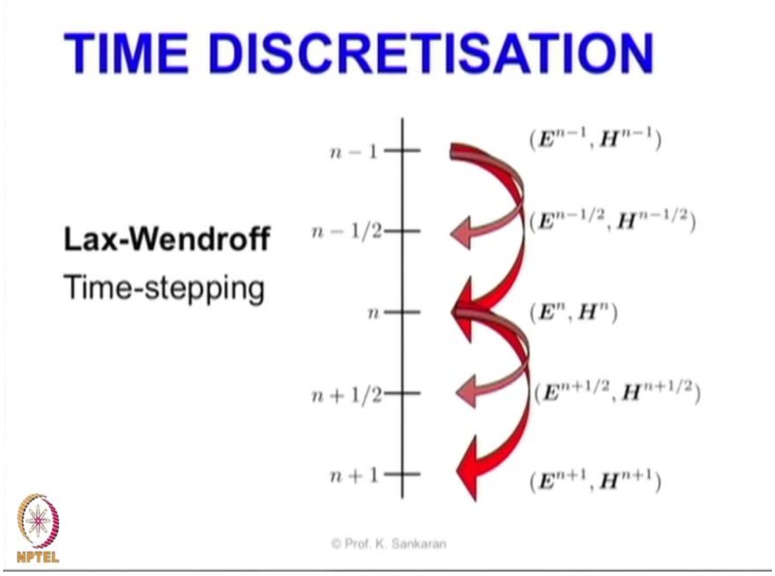
The Geometrical reconstruction scheme as alternatives to the more popular Godunov and MUSCL approaches

(Refer Slide Time: 01:50)



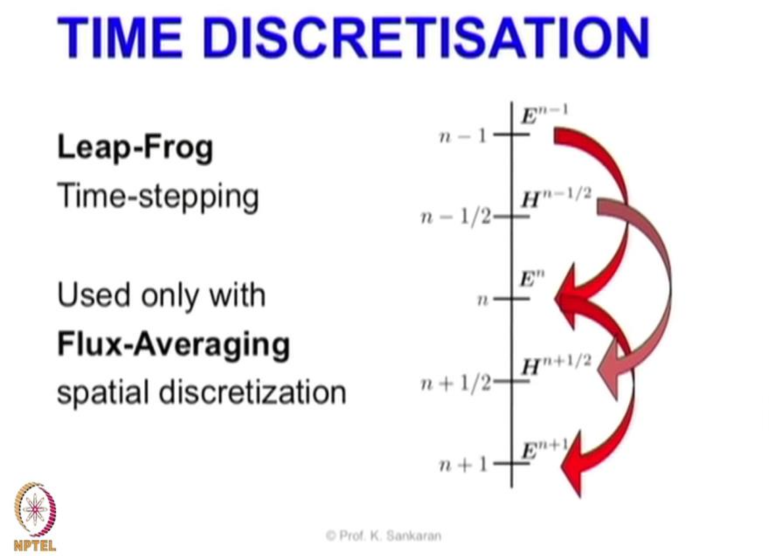
Later we explained the time discretisation for the finite volume method

(Refer Slide Time: 01:57)



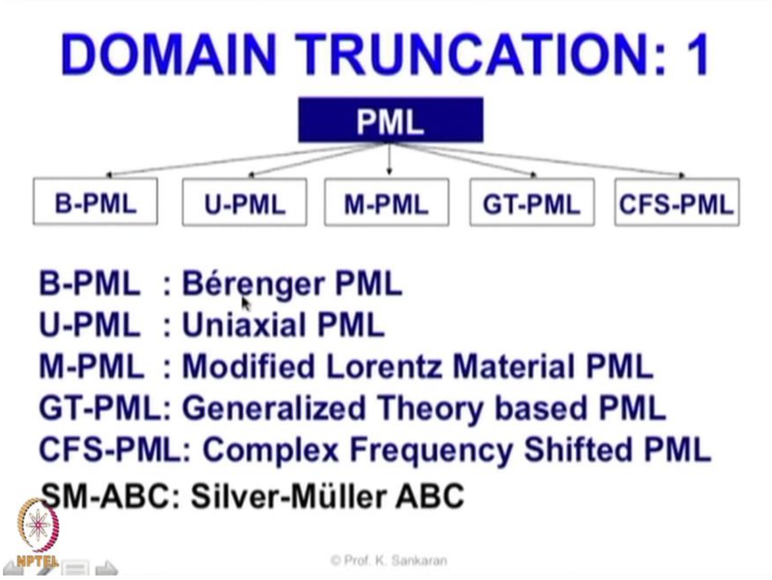
We elaborated the most widely used Lax Wendroff

(Refer Slide Time: 02:01)



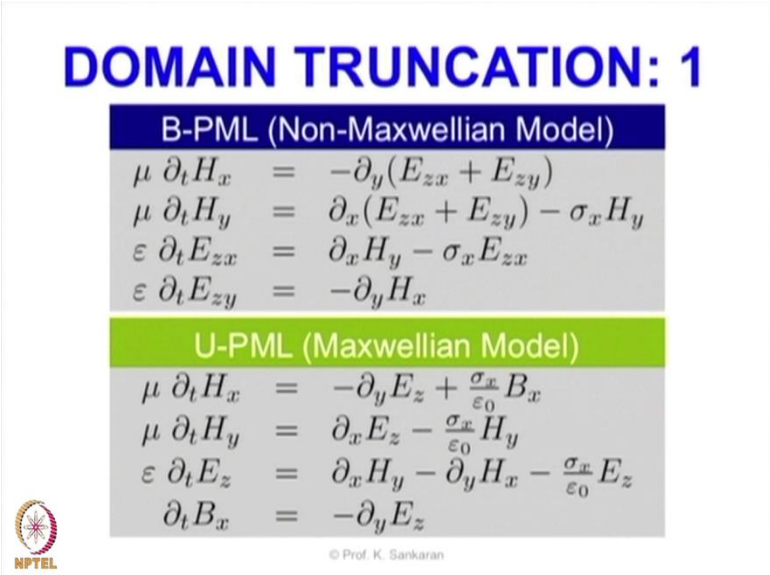
And Leap Frog time stepping schemes for Finite volume method

(Refer Slide Time: 02:07)



Finally we introduced certain accurate domain truncation techniques in the Finite volume framework. We first discussed the simple Silver Muller absorbing boundary condition and then introduced the more accurate perfectly matched layer approach for Finite volume method

(Refer Slide Time: 02:33)

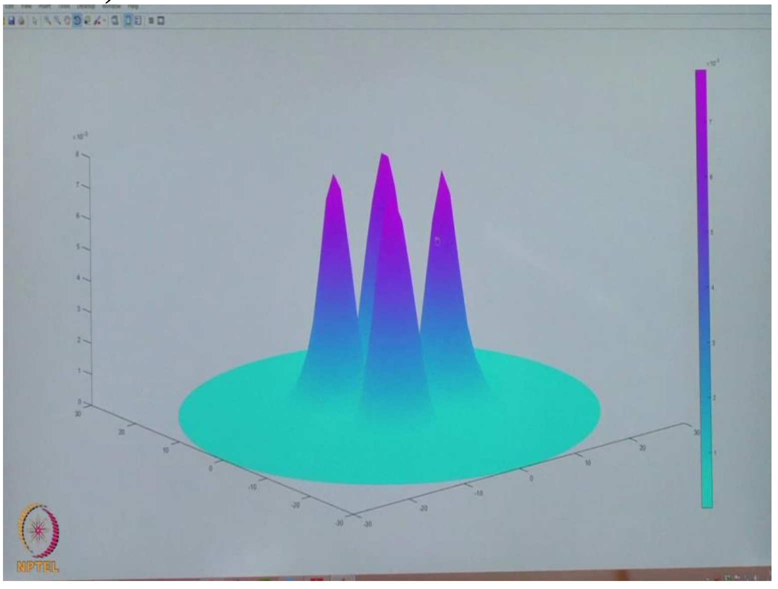


We discussed two broad classes of perfectly matched layers namely the non Maxwellian Berenger PML and the Maxwellian Uniaxial PML.

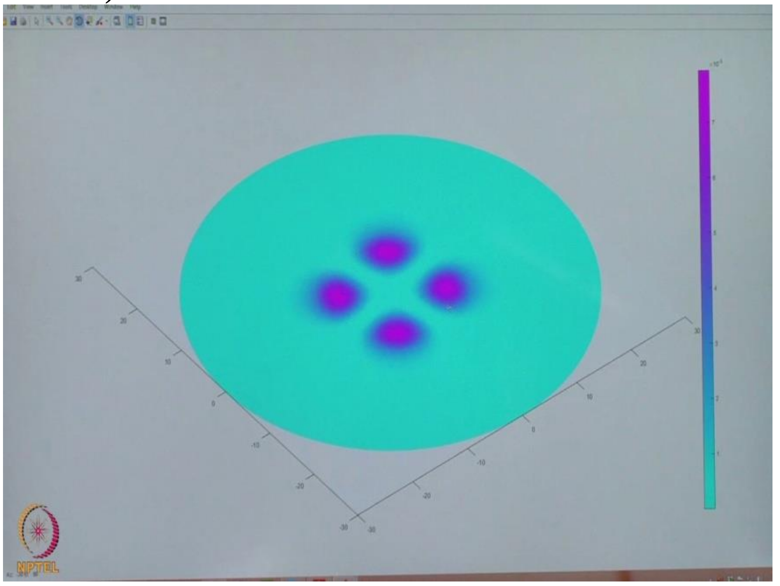
(Refer Slide Time: 02:47)

In the lab tour we discussed a modelling exercise involving a multi mode optical fibre

(Refer Slide Time: 02:55)



(Refer Slide Time: 02:56)



And we simulated various mode profiles for this multi mode fibre.

Please go through the concepts and examples that we discussed in this week. We will be dealing on these basic ideas in the next weeks lecture. Post your questions in the forum clarify your doubts and get ready for the next week until then Good Bye!