Inverse Methods in Heat Transfer
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Lecture No 11
INTRODUCTION TO WEEK 03

Welcome back. This is week three of inverse methods in heat transfer, a course on NPTEL This is essentially an undergraduate level course, which introduces you to inverse methods in heat transfer. This is week three this video is just a brief introduction of the contents of week three.

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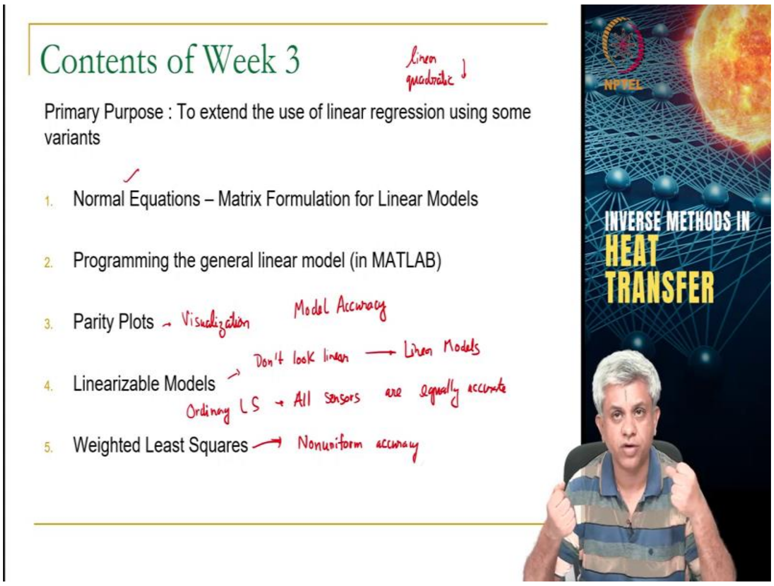

The primary purpose of this week is to extend the use of linear regression, using some variants. So, last week we saw linear regression applied to linear as well as quadratic functions and this week we will try and write it in a way and extend it to a very general sort of linear model and you will understand basically what general linear models mean and how they can actually be very powerful even though they look like a very simple set of models.

So, the heart of this which enables this is something called the normal equations. This is basically last time we wrote it as scalars, the equations that we wrote were scalar equations and this time we will try to reformulate the problem in a matrix form. So, this is the Matrix formulation for linear models and these are known as the normal equations and we will then see, how to program these normal equations or the general linear model within the MATLAB setting.

Of course, you can extend this to any programming language whatsoever, but specifically within this course, we will be using MATLAB because these are most easily accessible to ah beginners. We will program the general linear model and I will show you ah how it makes a difference ah if you program it in a scalar sense, which we did last week versus if we program it as a matrix, which we will do this week.

And you will see that in order to extend just a linear model, to quadratic, to a cubic or any other type of ah linear model, it becomes very easy if you use these normal equations as against the scalar equations. you might remember that when we try to redrive the quadratic equations or if you did the assignments last time, you would have found it at least a little bit difficult to do so and part of the reason was to redo it using a matrix formulation. So, we will be showing you how to program that.

Now that we have extended to a general case, we want a general visualization technique. So, a parity plot is a visualization technique, that works regardless of whether you are dealing with linear, quadratic or multivariable linear models. So, it is a nice way of actually compactly looking at how well your model is performing. So, this is model accuracy. we saw the goodness of fit last week, but goodness of it is just one numerical thing but in order to see what it actually looks like we will look at parity plots. So, it is a compact way of doing this.

So, then we look at not only polynomial models but linearizable models, which are which are models that do not look linear, but can be turned into linear models. So, and oftentimes in heat transfer, for example, unsteady conduction there are some simple cases and in fact you will find some exercises within this week just for that. So, these are models that can be turned into linear even though they are not outwardly looking linear.

Finally, we will look at a case which is a practical case. let us say if you remember the last week, we looked at this case of a slab with multiple thermocouples and there is an implicit assumption in normal least squares, which we call ordinary least squares, that all sensors which function for inverse problems, let us say thermocouples are equally accurate. But what do we do, when we have non uniform accuracy that is what where you use weighted least squares.

So, we will derive that and we will sort of not rederive at least I will give you the normal equations for weighted least squares also. So, that now you are ready with a very general model where you have multiple sensors, but all of them are having different accuracy. So, you can solve the general problem at the end of this week. So, this is a big picture view of what happens within week three. I will see you in week three. Thank you.