Dealing with Materials Data: Collection, Analysis and Interpretation
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Lecture No. 92
Case studies: Introduction

Welcome to dealing with materials data. We are looking at the collection, analysis and interpretation of data for materials science and engineering.

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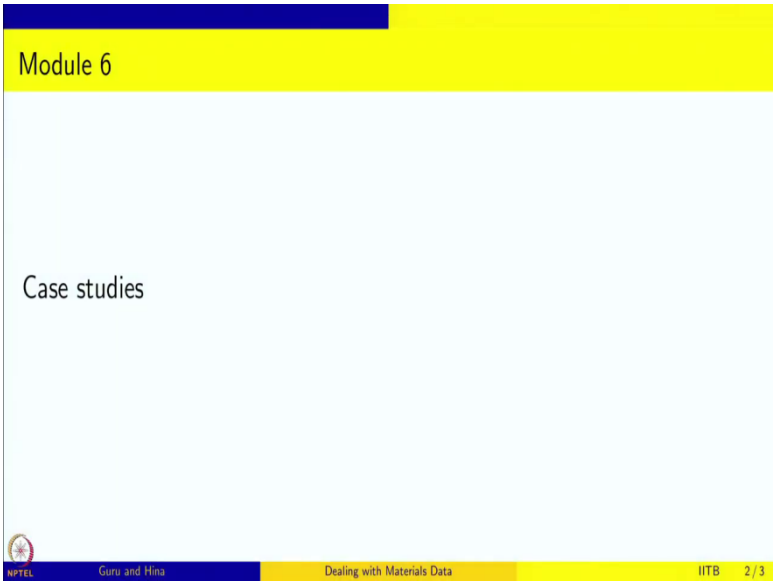

We have done till now five modules in R, this is the last module and this is the module of Case Studies.

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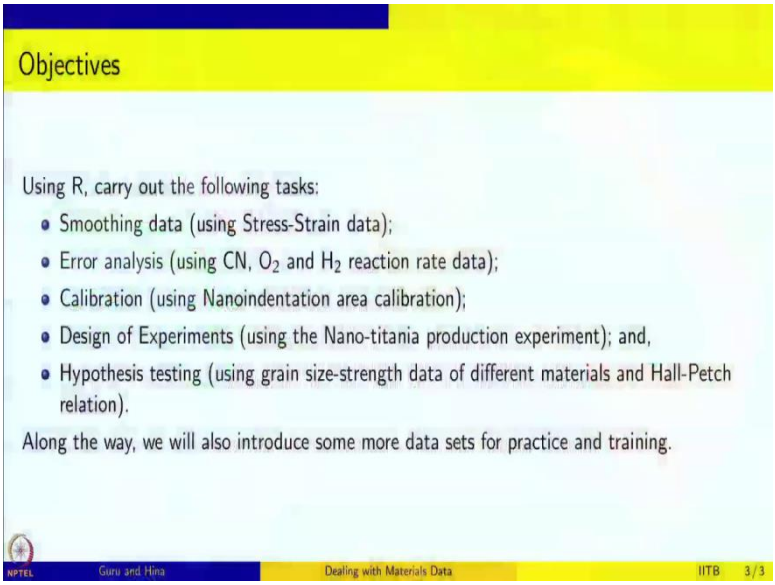

Specifically in this module we want to do five problems using R and we will also introduce some more data sets for practice and training for yourself and this is also the time for you to take your own data sets, which are available with you and do some of the things that we have been doing with the data sets; like descriptive analysis, for example, or trying to fit models for example, trying to get values of a mean or the distribution of data and things like that.

But in this module, we are going to do five problems. First is smoothing of data, which is an important thing to do. So, we will use a typical Stress-strain data as an example to understand how smoothing is done. We have already done error analysis, but we will see that the ideas of error analysis are useful in other places too. For example, we are going to take the cyanide and hydrogen reaction rate data and we have already done some fitting.

But we did not pay too much attention to errors and how to account for errors and how to give error bars on the results. So we will spend some time doing that. And the third problem is calibration, which is an important thing. We have discussed calibration at the beginning of the course as to how one should keep calibration and keep the calibration information in mind to avoid systematic errors.

So in this module, in one session, we will try to take the data from nano indenter and find out how calibration is carried out and typical calibration leads to some curve fitting or some tabulation of data, so we will see how this is done in this context. And you have also learnt about design of experiments, so we will take the same problem of Nano Titania production experiment and do the design of experiment analysis on R, using R.

So you have already seen the problem, you have already seen how it is done, but we will do the corresponding R session, so that you can use similar ideas to for designing your own experiments. Finally we will talk about hypothesis testing and we will use the Hall-Petch relation and grain size versus strength data for different materials as the case study.

And we will use all the tricks and techniques that we have learned in terms of fitting data, finding parameters, giving confidence levels for those parameters and even doing Bayesian analysis on the data. So if you already have some data, can we use this prior knowledge to interpret results that we get now? So these are the five problems we are going to do and these are more open ended and you will see that some parts we do and some parts we request you to do.

Just to give you an idea that there are things that you can do yourself and you should make it a practice to take different data sets that are available to you and do all of these thing and try to understand them, so this way it will improve your understanding of data of the material science that you are trying to learn and understand, as well as practice for R to do some of these practical problems. So, we will do these case studies one by one in this module. Thank you.