

# Application of inverse analysis simulation technique to characterise material properties using instrumented indentation experiments

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## Aim of the project

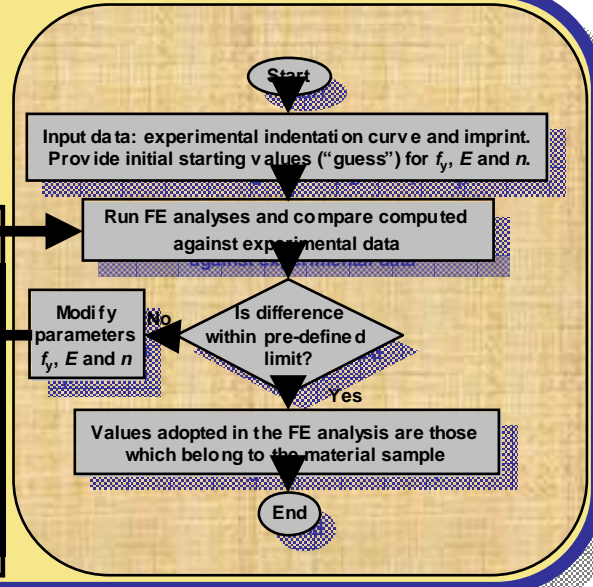
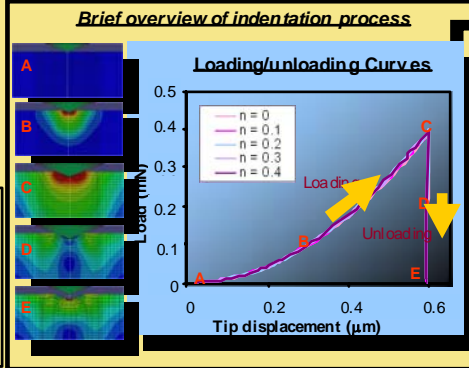
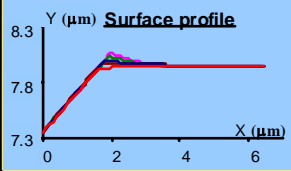
The aim of this project is to develop and implement a robust inverse analysis technique for the characterisation of the mechanical properties typical of metals based on indentation tests.

The input data utilised in the proposed inverse analysis consists of:

- (i) the loading-unloading indentation curve
- (ii) the imprint remained on the sample after the indentation



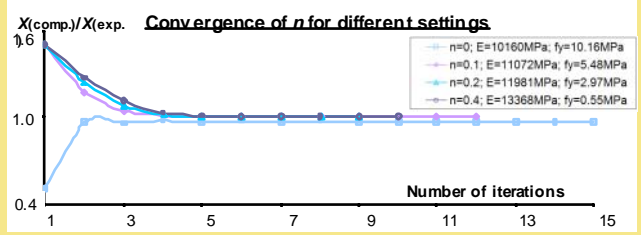
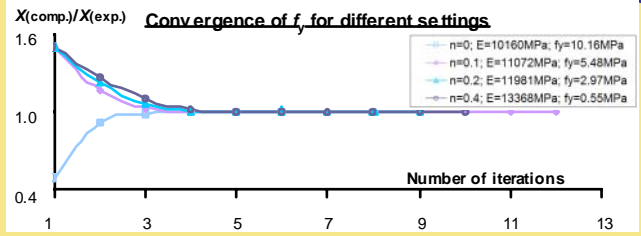
UMIS® Nanoindenter (Courtesy CSIRO)



## Computer Generated Experiments

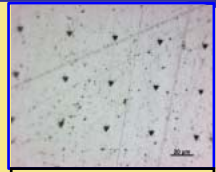
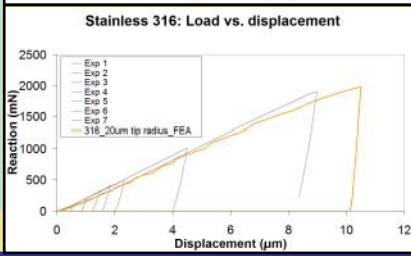
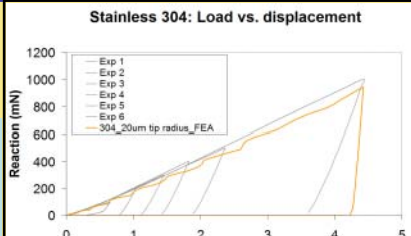
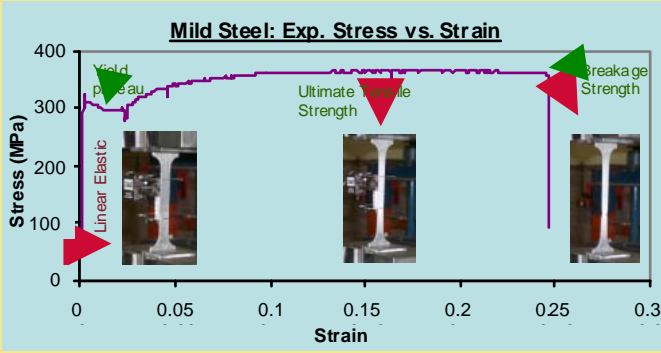
The approach has been used for metallic materials obeying Hollomon-type equation having Young's modulus  $E$ , yield strength  $f_y$  and strain hardening exponent  $n$  as variables.

Computer generated tests are carried out to validate the robustness of the inverse analysis. All the initial material properties are pre-defined and the inverse analysis is tested for convergence by applying a known factor  $f$  of 0.5 and 1.5 to the parameters. An example of such a test is shown for the following set of materials identified by  $E$ ,  $f_y$ , and  $n$ .

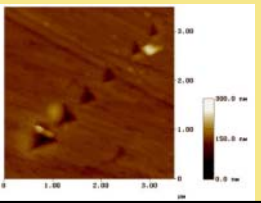


## Experimental Testing on Stainless Steel Samples

The following shows experimental results of tensile and Nanoindentation tests of two types of stainless steel for future treatment with the inverse analysis.



Optical micrograph of nanoindentation imprint



A typical AFM scan of the imprint

## Acknowledgement:

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