**INTERDISCIPLINARY CENTRE FOR
ADVANCED MATERIALS SIMULATION**

The ICAMS Seminar presents

Prof. Dr.-Ing. Norbert Huber
GKSS Forschungszentrum Geesthacht

Monday, 15th of June, 4 p.m.
ICAMS Seminar room UHW 11/1102

"On the role of residual stresses in indentation testing – An example for knowledge generation using computer methods and brain "

Artificial neural networks can be used to solve complex inverse problems, e.g. the identification so the stress-strain behaviour from spherical indentation. The talk will discuss a possible application of this method for determining local mechanical properties in welded components, as they are relevant for light-weight design in an aerospace fuselage. Welded structures always have a residual biaxial stress state in the welded area with a major component in longitudinal direction. For more than a decade we know that residual stresses can have a strong effect on the result of an indentation experiment. The effect of residual stresses can generally be simulated in experiments by simple bending (uniaxial stress state) and in finite element simulations by application of transverse stresses as a boundary condition (typically equibiaxial). Many researchers have used these approaches to develop models that allow the prediction of this effect; others have proposed models to determine residual stresses from indentation or hardness testing. The training of artificial neural networks (ANNs) allows also analysing the relationship between independent (stress state) and dependent quantities (load, hardness) using a large number of finite element simulations. Based on the experience gathered from the ANN results and finite element studies, a simple analytical model was developed, which allows predicting the effect of an arbitrary residual stress state on the measured hardness with an accuracy of better than 5%. Using this model it is easily possible to estimate errors in hardness measurement of to correct hardness data if the in-plane residual stresses can be measured.

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