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ADVANCED NUMERICAL STRETEGIES FOR DATA ASSIMILATION USING RICH EXPERIMENTAL MEASUREMENTS TRACK NUMBER 1700

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ABSTRACT

Experimental solid mechanics has been experiencing a genuine digital revolution since the beginning of the century, due in part to the use of a large number of new instrumentation techniques including digital imaging. These techniques provide access to rich experimental data that may change fundamentally the way scientists and engineers develop numerical models.

As both the diversity and definition of imagers are increasing (e.g. optical, x-ray, computed-tomography, scanning electron microscope, tunneling electron microscope), and the volume and heterogeneity of the measured data are also increasing, the classic data mining techniques used to quantitatively exploit these large data-sets are no longer sufficient. In the end, sometimes several hundred gigabytes of heterogeneous data can be generated to determine a single quantity of interest or to characterize only a few parameters.

To address this issue, many new disciplines have emerged, like data assimilation, which seek to optimally combine a numerical model with observations to:

- determine initial or boundary conditions for a numerical model,
- interpolate sparse observation data using the mechanical knowledge of the region being observed,
- train numerical model parameters based on rich experimental data,
- build numerical models as close as possible to a given real configuration (image based models),
- optimise experimental setup parametrisation (e.g. sample shape, loading conditions).

Depending on the goal, different solution methods may be used. The purpose of this symposium is to explore different data-based modelling methodologies with their associated computational algorithms. The emphasis is on techniques to assimilate rich, full-field, heterogeneous experimental data with computational simulation, in order to improve the accuracy and predictive capability of the models.