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MODELLING AND SIMULATION OF WELDING AND WIRE ARC ADDITIVE MANUFACTURING PROCESSES

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ABSTRACT

Numerical modelling of welding and WAAM processes becomes a decision making tool used to speed up the development and qualification of welding and repair techniques. Both computation welding mechanics which concerns the modelling of welding effects in the base metal and in the weld at solid state (temperature field, microstructure, stress and strain distribution…) and multiphysics simulation which focuses on arc/plasma and weld pool modelling can be implemented for this purpose.

This minisymposia is organised by the Scientific and Technical Committee on Numerical Welding Simulation with the help of the French Association of Mechanics (AFM). The goal is to make an update of the progress made in welding and WAAM concerning:

- modelling of the process what can we model today and with what accuracy, what are the couplings effects to be taken into account;
- behaviour laws (metallurgy, hardening recovery, viscous effects, simplified methods, ...);
- real-life size structures (life time, match computation time with industrial needs, ...).

These elementary bricks will be helpful to characterize the overall welding process in order to numerically simulate the behaviour of a structure (distortions, fatigue resistance, damage), while relying on cases validation tests (calculation / test comparison).

Topics of the minisymposia on modelling and simulation of welding and wire arc additive manufacturing processes in the broad sense will include:

- Very large structures, thick components, how to simulate the very large number of passes?
- Performance and process control: multiphysics advances for the simulation of welding processes (molten bath and arc) allowing high quality welding.
- What are the benefits of integrating the manufacturing history to justify the lifetime.
- Effect of welding on the service behaviour of welded joints (low cycle fatigue, stress corrosion, fracture ...).
- New models of welding simulation to improve the controllability of structures and make NDT diagnostics more reliable.
- Simulation of heterogeneous welding.
- Special processes (reloading, repair, FSW, resistance, Hybrid, ...).
- Residual stresses and distortions, control of the risks of cracking during welding.
- State of modelling materials for welding simulation.
- Wire Arc Additive Manufacturing process.
- Research and experimental computational tools.