ADVISE

ADVanced Inspection of Complex StructurEs

OBJECTIVES

ADVISE aims to advance the ultrasonic inspection of complex structured materials, for which conventional ultrasonic techniques suffer from severe performance limitations due to the micro and/or macro-structure. In particular, ADVISE will :

- Increase the comprehension and modelling of complex structures for accurate prediction
- Develop new tools for material characterisation and input data
- Provide advanced inspection methods
- Provide defect evaluation methods and assisted diagnostics
- Raise awareness

The main output of the project is thus a step change improvement in performance in terms of inspectable depth, defect detection and characterisation accuracy. For austeno-ferritic cast components, an increase of the inspectable depth of 70 to 85 mm is aimed for. Equally importantly, the in-situ characterisation for specific inspections will provide the confidence needed to make safe decisions from measured indications without the significant conservatism that is needed in many cases currently.

DESCRIPTION OF WORK

To achieve its objectives, ADVISE will rely on the following work packages:

WP1 "Comprehension and modelling" lays the groundwork by working on the understanding of the impact of a polycrystalline structure on an ultrasonic wave, which is particularly relevant for experimental access to the microstructure. WP1 also provides the necessary modelling tools and recommendations for their use in the following work packages.

WP2 "Material characterisation and input data" builds upon this result to provide the material characteristics, which are required by WP3 and WP4. WP2 explicitly distinguishes the fundamentally different structures of welds and cast components, accordingly handling both macro- and microstructure.

WP3 "Advanced inspection methods" targets model-based design of transducers and inspection techniques for coarse grained structures, utilizing tools, knowledge and data developed in the preceding WPs to generate bespoke inspection solutions.

WP4 "Defect evaluation and assisted diagnostics" produces the model-based analysis tools to fully exploit the information provided by the tailor-made inspection techniques developed in WP3.

WP5 "Integration and application" provides the required glue to assemble and interface the components developed in the preceding WPs, and applies them on a number of industrially relevant cases with increasing complexity. WP5 disrupts the sequential order by providing continuous feedback and experimental benchmark data to WP2 to WP4.

WP6 "Dissemination, exploitation and management of innovation" accompanies the project to raise awareness of the project's results within the nuclear community and prepare and handle the exploitation of these results.

WP7 "Project Management" provides the strategic and operational management of the project during its entire duration and also involves the industrial stakeholders via an Industrial Advisory Board to ensure a permanent focus of the project to their needs.

MAIN RESULTS / HIGHLIGHTS

ADVISE will deliver:

1. Methods to:
   - Measure the properties of NPP materials that cause difficulties for their inspection by ultrasound, including grain size, wave speed and attenuation and their spatial variations
   - Simulate ultrasound propagation, attenuation, scattering and interactions with defects in the materials under concern; these methods will be vital tools for the evaluation and optimisation of any target inspections.
   - Optimise the performance of ultrasound inspection. This will include the parameters of ultrasound arrays, data acquisition, signal/image processing, and interpretation. Performance will include both detection and characterisation.
2. Simulation tools, imaging tools and diagnostic tools (software and hardware) dedicated to complex materials
3. Physical demonstration examples using real materials and representative target defects, showcasing the new methods and optimised NDE capabilities
4. Public workshops, training sessions and publications for broad dissemination

DURATION

1 September 2017 – 31 August 2021

4 years

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PARTNERS

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