Doctoral candidate 7: High resolution 4DCT of smart materials

Host Institution	The institute of Theoretical and Applied Mechanics of the Czech Academy of Sciences
PhD enrolment	Technical University of Denmark
Primary Supervisor	Dr. Daniel Vavrik
Subject area	4D Computed Tomography, Instrumentation, Emergent materials, Damage evaluation

About this doctoral project and your tasks

The proper arrangement of a 4DCT experiment in terms of the optimal setting of HW and SW parameters is in itself a complex task. 4DCT measurements have to be optimised with respect to capturing the monitored time-dependent processes with appropriate temporal and spatial resolution and also with respect to the amount and rate of data recording.
You will develop, implement and evaluate scanning protocols, optimised CT scanner setup and related acquisition scripts/software for data acquisition to observe and analyse time-dependent processes caused by mechanical, chemical and thermal effects. You will focus on new 4DCT methodologies and instrumentation to achieve significantly higher spatial and temporal resolution than current methods applicable for investigation of smart materials behaviour under service life and extreme conditions. To improve the visibility of structures in low contrast materials, the use of propagation-based phase contrast methods will be further developed. Physical models of materials and structures, including consideration of damage and stability, will be developed based on 4DCT data, which will also be used to validate and update numerical simulations.

Your tasks will include :

- An innovative and generic 4DCT experiment design, with special emphasis on achieving superior spatial and temporal resolution;
- Integration of the X-ray imaging and mechanical loading equipment to one feedback-controlled system for scanning smart materials in-situ;
- Design, engineering and optimisation of the smart material systems using 4DCT analysis;
- Two mandatory courses during one semester of doctoral studies at Technical University of Denmark (DTU).

Foreseen secondments

For this project, we foresee secondments to:

- **Prof. dr. C. Heinzl** (4 months) at Fraunhofer IIS (Germany)
- **Dr. Arjen Mascini** (4 months) at Tescan XRE (Belgium)
- **R. Mokso** (4 months) at DTU (Denmark)

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