# 3D experimental and numerical fatigue crack analysis

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Fatigue cracks are three dimensional objects in essence, but the lack of 3D data about crack propagation in optically opaque materials has made necessary the development of simplified 2D fatigue models. Efforts have been made in the last 20 years to develop both experimental and numerical techniques for investigating and predicting the behaviour of fatigue cracks within the bulk of opaque materials. A combined experimental and numerical research program has been planned to improve the understanding of 3D crack behaviour and growth.

This presentation will be devoted to the presentation of the main results of the Propavanfis research program. This research was devoted to the study of full 3D fatigue crack propagation in metals. The idea was to perform 3D fatigue crack propagation experiments using tomography which allow to follow crack propagation within a specimen without destroying the specimen and to compare with 3D X-FEM simulation. A nodular graphite cast iron was used. The following tools were used:

- X-ray microtomography to visualize various states of a fatigue crack within a volume made of cast iron,

- eXtended Digital Volume Correlation (X-DVC) to measure in situ displacement fields in the bulk in the presence of a crack, and identify stress intensity factors along the crack front,

- eXtended 3D Finite Element Method to analyze stress intensity factors by considering the experimentally determined crack geometry.

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