

Using ABAQUS Cracktip Submodels to Investigate Cracking in Conventional Power Generation Plant

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Abstract: In the UK, conventional fossil fired plant is operated flexibly, some has now operated in excess of 5,000 starts and there has been an increase in the occurrence of crack initiation and propagation in a variety of components and from a variety of features.

Three previous papers by the same authors have been presented on this topic which detail results for straight and curved cracks in generator rotor teeth. ABAQUS submodelling is used with a 'simple cracked' C3D8 global model driving a C3D20 submodel containing the 'crack tip' mesh.

Rotor geometries are relatively easily meshed by sweeping, this paper extends the method to use a C3D10 tetrahedral global model applicable to conventional power generation plant. Tetrahedral mesh is controlled using the external face mesh with little control of the 'internal' mesh. In this paper the solid is partitioned to ensure a fine and even mesh around the crack tip and at the driven nodes.

The 'crack tip' submodel is made by sweeping and can be fully buried, it need not extend to the surface boundary, which can be problematic if this is not normal to the crack tip. The global model can contain many cracks and the same cracktip submodel can simply be repositioned to extract crack output at as many crack locations and directions as required.

The complexity of traditional crack modelling has restricted its use to fairly simple geometry, this method however enables cracks to be effectively modelled in any general solid.

Keywords: Crack Propagation, Crack Modelling, Crack Submodel, Fracture, Power Plant, Generator rotor, Remaining Life

1. Introduction

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