

C3D-CND, Modelling the Eddy Current Inspection for 3D complex geometries

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EDF has developed a 3D finite element tool for the Eddy Current (EC) simulation in ferro-magnetic tubes and plates. This tool highly benefits from the strong experience gained by EDF in previous decades on building large-scale 3D codes for thermomechanics and thermohydraulics in french nuclear plants. Our EC code is principally enhance for EC inspection of the steam generator tubes, leading to the C3D-CND software, including: - an user oriented GUI to compose EC Testing configurations by assembling components, such as : standard tubes, perfect or out-of-shape, a large variety of tube defects, and optionally, interfering elements in the vicinity of the defect, such as antivibratory bars, tube support plates, or ferromagnetic volumic deposits. All of them can be drive as well as the EC probe; from a component library, and they can be modify by the user for its own need. - to fulfill the numerical cost which naturally results of such 3D Finite Elements models, a high performance computing manager is embedded in the GUI Interface, adresssing the large scale server clusters of EDF. These resources are accessible to EDF's partners via a streamlined process. The main interest of C3D-CND is the realistic modelling of the influential parameters of the EC inspection, which are most often geometrically complex and random and which require an accurate prediction for a reliable probabilistic accounting. Since 2019, developments in C3D-CND have been carried out in accordance with the tool's software quality plan. An important component of experimental validation is currently being implemented on rotating probes. The validation of C3D-CND is mainly carried out by EDF, but also by our partner EPRI (Sonde Plus Point).