

Investigation of CFD-DEM momentum coupling results for AWJC Nozzle using preCICE

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ABSTRACT

The high-speed water jet is the momentum source in an Abrasive Water Jet Cutting (AWJC) Nozzle. This momentum is transferred to the abrasive particles and the air within the nozzle. This leads to turbulent and complex particle-laden flow in the nozzle. These flow conditions can influence particle impacts on the nozzle, thus influencing erosion. Hence it is imperative that this complex particle-laden flow is captured correctly.

Our prototype[4] uses preCICE[2] for volumetric coupling of eXtended Discrete Element Method (XDEM) [1] (for the particle motion), and OpenFOAM[3] (for the fluid). XDEM uses fluid flow conditions to compute the forces acting on particles. XDEM computes the particle momentum source that is communicated to the fluid solver using the preCICE library and its adapters. This momentum source is injected into the fluid solver as a source term.

It is important to investigate the coupled CFD-DEM results as the momentum exchange can be directly from the water jet to the particles or indirectly through the airflow. Subsequently, the particles also influence and alter the fluid flow inside the Nozzle. We investigate the influence of different particle inlet conditions on the particle-laden flow. The results of the coupled simulation align with literature[5]. As the particle-laden flow is captured correctly, this coupled simulation can be extended to include the FEM component for erosion predictions.

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