

# **INTERNAL EROSION PREDICTION THROUGH CFD FOR SUBSEA PIPEWORK**

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## **ABSTRACT**

INTECSEA employs Computational Fluid Dynamics (CFD) to estimate the internal erosion occurring within subsea Oil & Gas equipment due to sand particles carried by the produced hydrocarbons.

The case study presented is the erosion assessment undertaken for a subsea High Integrity Pressure Protection System (HIPPS), an instrumented piping system aimed at protecting subsea flowlines from overpressure.

Through CFD modelling, the maximum erosion rate was estimated at the design stage to ensure the integrity of the pipework during the equipment life.

The analyses are performed using commercial CFD package ANSYS CFX 14.0, with a FORTRAN user subroutine to calculate erosion rates based on the flow conditions predicted and an empirically developed erosion model. In addition, advanced models for parallel and perpendicular restitutions have also been implemented using a subroutine to have physically realistic sand particle interaction with walls.

The models were initially calibrated for simple geometries (single bend) against empirical results. From the results of the calibration a correction factor was calculated to adjust the maximum erosion rate predicted.

Due to the complex geometry involved, the HIPPS system was split into the HIPPS module and the HIPPS manifold, and for each of those sub-models a 3D single phase steady-state flow with mixture properties was simulated to predict the sand particle trajectories across the pipework.

CFD simulations helped in tracking the sand particle trajectories accurately throughout the system and identify the locations of erosion "hot spot", and provided the maximum local erosion rate. The results of the analyses are also used to improve the design of the equipment with regards to erosion.

The main benefit of using CFD for erosion prediction was that it was possible to understand the complex flow mixing at various junctions in the system. It was highlighted by the study how complex mixing of multiple flow streams lead to acceleration of flow and particles which in turn results in the increased erosion.

## **SUGGESTED THEMES**

Keywords: Internal Erosion, CFD, Subsea Piping, Subsea HIPPS

