

Advanced Modelling & Simulation - AMS

CASE STUDY

BYPASS PIGGING IN OIL & GAS TRANSPORT OPERATIONS

Pigging operations produce slugs which can introduce highly varying liquid flow rates at the end of the pipeline, resulting in potential slug catcher overflow, and trip in the gas line when gas production ceases momentarily. Use of CFD is proven efficient.

OVERVIEW

Pigging refers to maintenance practice for pipelines using 'pipeline pigs', for cleaning (removing debris, wax, hydrates, powder) or inspection of pipeline without stopping operation. Pipeline pigs are capsule shaped objects which travel through the pipeline, cleaning the inner walls of the pipeline by brushing action (e.g. Fig. 1).

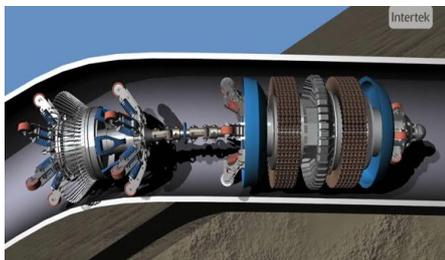


FIG. 1. PIGGING IN A GAS PIPELINE

The risks involved in pigging operations include: Exposure to high pressure hydrocarbon gas or condensate, physical exertion required to operate manual process valves or handling pig, potential loss of containment of hydrocarbons through leaking flanges or opened valves, and risk of igniting released hydrocarbon gas or condensate.

OUR SOLUTION

Pöyry's AMS section gathers a team of experienced CFD experts relying on their own CFD/CMFD proprietary tool TransAT. The code is based on two-phase flow simulation technology coupled with full rigid body motion needed to mimic the pushing of the liquid mass downstream of the pig in this case.

YOUR BENEFITS

CFD multiphase flow simulation can be used to assess operation of a pig for a multitude of boundary and flow conditions, improve operational safety through quantitative prediction of pipeline flow regime during pigging operations, support flow-assurance during operational pigging, and support design process of different pigging devices.

ASSET DESCRIPTION

The test case consists of a 2D pipe with a moving pig as shown in Fig. 2. Dimensions and flow conditions are presented in the table. The pipe has an initial liquid layer, which is shown to be displaced by the pig motion (Fig.3), scrapping the surface downstream.

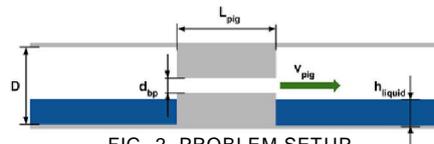


FIG. 2. PROBLEM SETUP

Dimensions	Operating Conditions
Pipeline length: 30 m	Product: Multiphase
Pipeline diameter: 1 m	Gas sup. velocity 5 m/s
Pig length: 2 m	Oil sup. velocity 0.6 m/s
Bypass ratio: 9%	Pig speed 2 m/s

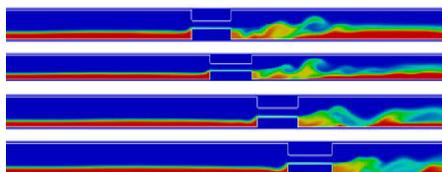


FIG.3. RESULTING FLOW DISPLACEMENT WITH THE PIG MOTION

The simulation result suggests that many other pigging-related scenarios can be predicted using the same methodology.

COMPLIANCE

Avoid reliance on trial and error approach to mitigating pigging issues and potential shutdowns due to flooding of slug catchers.

PÖYRY'S AMS.

Pöyry's Advanced Modelling & Simulation (AMS) group provides consulting services in a broad range of industrial areas. The activities are centered on detailed simulation of fluid flow and heat & mass transfer processes pertinent to energy, industry and infrastructure.

AMS service is enabled by the CFD/CMFD product TransAT.

TRANSAT CFD/CMFD PLATFORM

TransAT is a versatile fluid-flow simulation platform (CFD) using the Immersed Surfaces Technology for multi-dimensional meshing. The platform is best suitable for multiphase flows using tailored predictive techniques and models for complex physics. TransAT can be used in the energy, industry and infrastructure sectors.

TransAT Website: www.transat-cfd.com