CFD for Offshore Safety Engineering

In recent years, there have been increasing uses of Computational Fluid Dynamics (CFD) as a modeling and simulation tool for a multitude of engineering applications in the Oil & Gas industry. Examples include flare design, flow assurance, dynamic fluid-structure interaction and many others. Of these, CFD has experienced tremendous growth as a consequence modeling tool in safety engineering.

Major offshore accidents in recent times have prompted operators and EPCs to step up safety measures, making Health, Safety and Environment (HSE) as one of their top priorities for all existing and upcoming projects.

A key component in safety analysis is Quantitative Risk Assessment (QRA). Risk is defined as the net outcome of event probability and its consequence. Probability relates to how frequently an event can occur. Consequence relates to extent of damage e.g. explosion over pressure, flammable cloud formation, temperature rise from thermal plume, radiation from fires, toxic gas accumulation and such. Traditionally, safety engineers relied on empirical or simplistic reduced order relations as a consequence modeling tool. However, with recent advances in CFD and computing technology, the focus has shifted towards CFD for improved accuracy and ability to model multi-dimensional flow.

This presentation will begin with a general introduction of CFD in the energy industry, with background and motivation for using it as the consequence modeling tool for safety engineering and risk assessment. Then it will go into specific examples, using STAR-CCM+ for various types of assessments that Atkins is involved with for the Oil & Gas industry. Finally, some of the challenges and limitations that still need to be addressed will be highlighted.

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