

# COMPUTATIONAL FLUID DYNAMICS (CFD) ANALYSIS

Zebec Marine Consultants and Services provides Computational Fluid Dynamics (CFD) modelling services and software suites for analyzing complex flows involving multiphase, mixing, combustion, heat transfer, and radiation.

Our CFD capability provides sophisticated solutions to a wide range of fundamental fluid problems combined with full scale measurements

The benefits gained from the CFD analysis are:

- Getting the design right the first time
- Predicting the impact of alternative design ideas
- Providing cost effective solutions to flow problems and reducing design time

## **Examples of work that can be undertaken:**

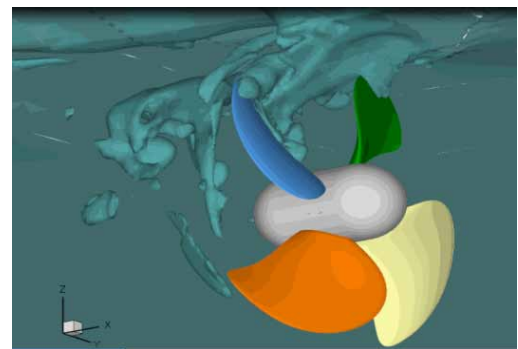
### ➤ **Hull form optimization**

- Assess static resistance of hulls with and without appendages
- Computation of speed to power curves after variation in hull form, propeller parameters, engine power and loading conditions
- Sinkage analysis of vessel



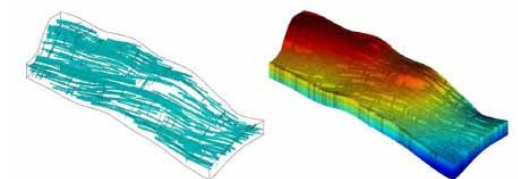
### ➤ **Propeller Cavitation**

- Simulation in varying flows to assess cavitation based on propeller specifications and engine power
- Optimizing the design for reduction in noise, erosion, vibration and improved thrust



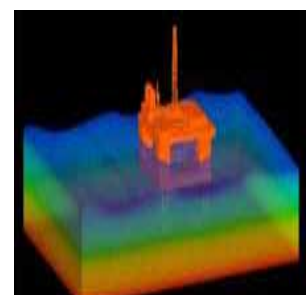
### ➤ **Reservoir Modelling**

- Discrete fracture network modeling
- Advanced meshing algorithms to capture fracture networks
- Surface, terrain and volume meshing
- Flow through porous media



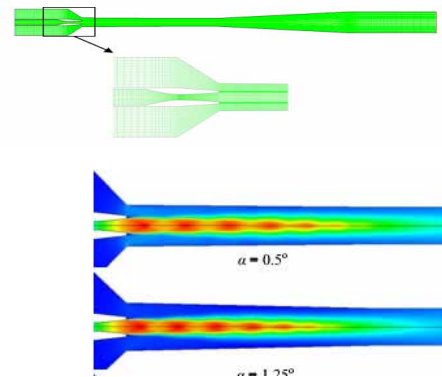
### ➤ **Offshore Assets**

- Wave slamming – offshore platforms, tension leg platforms, semi-submersibles
- Wind-loading
- Platform hydrodynamics
- Discrete phase flow
- Risk Management & Consequence Analysis – ventilation, flammable gas & liquid dispersion, fire/smoke propagation, explosions modeling



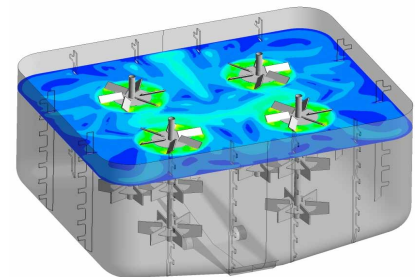
### ➤ Converging duct angle of ejector

- Supersonic flow inside the flow passage of steam ejector – axi-symmetric turbulent compressible flow
- Mixing tube with converging angle of 0.5 degree gives the highest value of entrainment ratio that is 0.941.
- Optimum design of ejector is at angle of converging duct of 0.5 degree



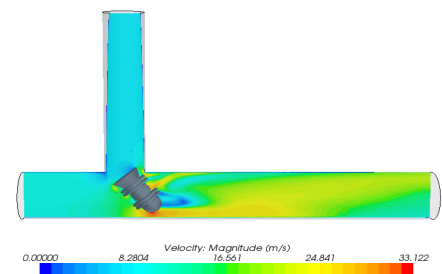
### ➤ Mixing

- Structural mechanics of a mixer
- Gas dispersion, Gas sparging and Glass-lined reactor systems
- High-shear mixers, Jet mixers and Static mixers
- Mixing vessel design (tank shape, impeller type, baffling level)
- Water treatment



### ➤ Flow Analysis of Pipeline Inspection Gauges (PIGs)

- Cold flow analysis of PIG is performed to evaluate the various operational parameters such as maximum and minimum pressures, forces on the PIG and flow profile when PIG is at the corner of the pipe, pressure drop analysis and so on....
- Velocity contours in the pipeline shows acceleration of the flow near bottom side of PIG. There is also a wake region behind the PIG which might cause additional drag and hence pressure drop



### ➤ Blast Impact

- Explosion prediction
- Modelling of peak overpressures and the associated impulse from the expanding gases of detonation as well as peak over-pressure and typical over-pressure time profiles
- Account the geometric effects of blast wave reflection and diffraction
- Calculate the evolution and movement of the blast pressure wave through the air and its interaction with surrounding structures
- Estimation of accurate blast pressure distribution across the structure



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