Saipem S.p.A moves FloEFD Offshore

Saipem S.p.A take advantage of FloEFD to support operations

Figure 1. The Saipem 7000: The world's second largest Semi-Submersible Crane Vessel (SSCV)

Saipem S.p.A, a subsidiary of Eni S.p.A, is a world leader in the oil and gas industry, providing engineering, construction and project management services to organizations in some of the most difficult operational environments in the world. Success in this industry requires engineers to balance experience with innovation in order that projects are delivered safely while ensuring that best practice constantly evolves with the latest tools and techniques.

The Naval Analysis Group in Saipem's London office focusses on supporting offshore heavy lift and pipeline installations for projects around the globe. As exploration has moved into increasingly challenging territory, the engineers and naval architects have sought to continuously invest in and improve their operational practice in order to better serve the operations they support.

A practical example of this evolution is the integration of FloEFD into their suite of tools. Computational Fluid Dynamics (CFD) has been used in the offshore industry for a number of years, often focusing on specialized applications such as heat transfer or multi-phase flow. However, the wider application of CFD beyond specialist groups has been limited by the complexities involved in geometry handling, meshing, and solution procedure. Not only this, but the hardware and time frames required to deliver solutions on anything other than the most basic geometries renders it difficult to use in operational environments.

Saipem saw an opportunity to address these issues through the adoption of FloEFD and first trialled the code in 2007. Following a successful evaluation period in which FloEFD was deployed to simulate a number of geometries including a semi-submersible crane vessel (Figures 1 & 3), a J-Lay Tower, and an offshore construction vessel, the program became core to its problem solving capabilities.

FloEFD afforded users at Saipem the opportunity to consider deploying CFD on problems which would previously have been too resource or time constrained to consider it. For example, when the increase in predicted towing force required for a Mobile Offshore Unit (MOU) was raised as a concern by the local project engineer, FloEFD was used to mesh, solve, and

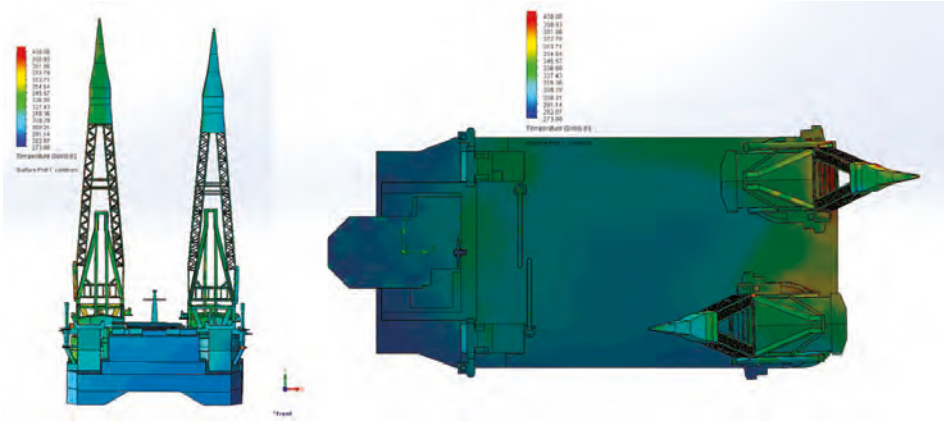

Figure 2. FloEFD Model showing Temperature Distribution during Flare Operation

provide a reliable prediction on capacity within hours of the original question being raised. In a similar fashion, FloEFD was able to provide assurances that temperature limits were not breached for crane operation in proximity to a flare stack (Figure 2). Without this reassurance, there was a real possibility that the certification of the crane would have been removed until all the cables were re-greased, resulting in considerable cost and loss of capability.

Pipeline construction is another example of where changes in operational requirements have required an innovation in the processes used at Saipem. As it becomes economic to exploit hydrocarbon reserves in deeper waters, so the traditional anchored laybarges used for pipelay and trenching increasingly give way to dynamically positioned construction vessels. Powerful thrusters are used on such vessels in order to generate the large tow forces required to cut deep trenches.

However, these high-power devices bring with them the risk of seabed scouring when used in shallow water operations (Figure 4). This presents an environmental issue and also risks causing the soil removed during the ploughing operation to be swept away, which would affect the ability to mechanically backfill the trench.

To develop a systematic approach to this issue, Saipem employed FloEFD along with established sediment transport methods. The result was a robust and cost effective solution which allowed the team to establish the susceptibility of the seabed to erosion by propeller wash. FloEFD could then be used to plan the operation to mitigate any potential deleterious effects.

In one notable instance of this method being deployed, FloEFD simulations were validated against a sonar survey of the seabed which was conducted following a ploughing operation. The results from the survey revealed good qualitative agreement between the simulation and the actual seabed profile.

The Naval Analysis team at Saipem have demonstrated how CFD can be deployed to aid day-to-day operations and complement existing tools. Furthermore, they've taken maximum advantage of what Saipem calls the "Engineering Orientated" nature of FloEFD on a range of projects. Being CAD embedded, providing intelligent assistance with defining the computational regime and being able to deliver results quickly without a protracted meshing process enables the users at Saipem to consider it as a genuine asset even when deadlines are pressing.

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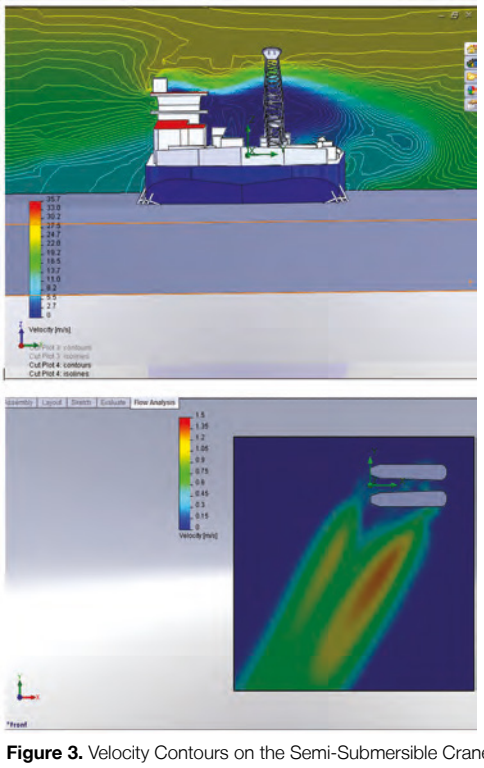

Figure 3. Velocity Contours on the Semi-Submersible Crane Vessel

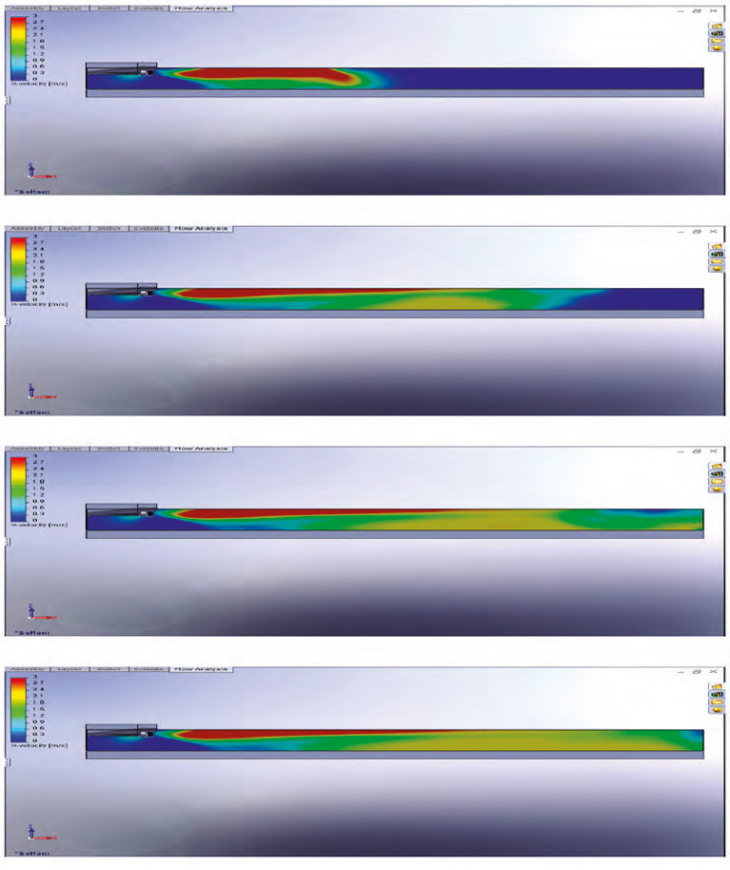

Figure 4. The Effects of Thruster Operations in Shallow Waters