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Collaborative Environment for Engineering Simulations with Integrated VR Visualization

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Abstract. We present an SOA for executing engineering simulations and visualizing results in a Virtual Environment. Different technologies of group work are used to compose a Collaborative Problem Solving Environment that enables engineers to setup computations in an integrated environment.

Keywords: Scientific Workflows, Virtual Environments and SOA.

1 Collaborative Engineering Environment

In this work we present a Service-Oriented Architecture (SOA) for a Collaborative Engineering Environment (CEE) for assisting the control and execution of Petroleum Engineering projects. Those projects usually require the execution of a large number of engineering simulations, in our work encapsulated as engineering services, combined in different orders and rearranged in different subsets according to project requirements. By means of a Scientific Workflow Management System users are able to orchestrate the execution of simulations as workflow tasks, and as its last step, the most interesting cases can be selected for visualization in a collaborative session.

1.1 Riser Analysis Workflow

Floating production units (oil platforms) use ascending pipes, called risers, to bring the oil from the wellhead on the sea floor to the oil platform's separator system tanks (Fig. 1). To certificate the operation of the risers for their entire life cycle (30 years or so), simulations of the stress applied to the riser system are conducted based on extreme meteo-oceanographic conditions data (wind, tide and water currents). The riser analysis software used is Anflex [1], an internally developed Finite-Element-based structural analysis package.

For automating the process of validation and certification of riser analysis we have defined an Anflex-based riser analysis workflow controlled by the BPEL engine (Fig. 1). Web services were also created for taking care of the other parts of the workflow.

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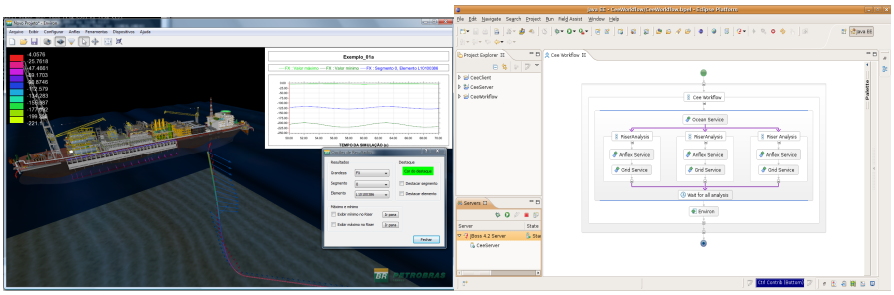

Fig. 1. Riser Analysis workflow

In the Collaborative Visualization Immersive Session, provided by Environ [2], results of the simulations can be analyzed by users in a desktop or in an immersive virtual environment. Among other resources, it is possible to playback the simulation, examine pipes, sea waves and ship movements, and track elements in the risers that are subjected to extreme conditions (e.g., high stress values). Annotations, private or public (shared) can also be created by the users, represented by distinct 3D-cursors, collaborating in a Environ Session where one of the users has created a private annotation that could be, for example, about an anomalous observed value (Fig. 2) .

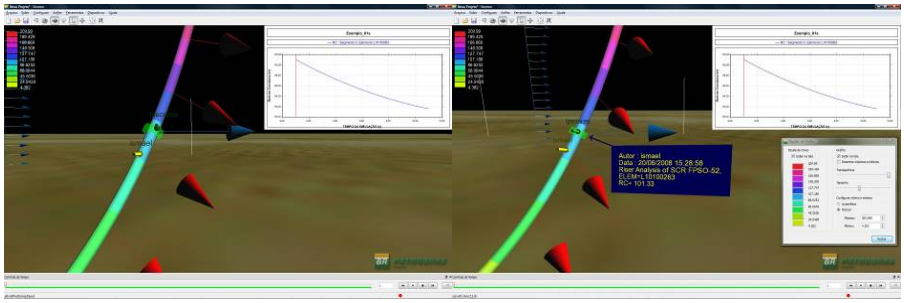

Fig. 2. Two users in a CEE collaborative visualization session

CEE is proving to be an effective Collaborative Problem Solving environment, allowing users to mitigate their problems during the execution of large and complex PE projects [3]. Although this work is focused on a solution for PE projects, we believe that the proposed CEE could also be used in other areas as well.

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