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# CONFIGURATION ANALYSIS OF FLEXIBLE RISER ENHANCED WITH BUOYANCY MODULES

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Flexible risers nowadays are essential elements of the oil and gas industry. The risers connect between wellheads at the seabed and floating production platforms on the sea surface. The risers can be installed in a number of different configurations according to production requirements [1]. It is often useful to incorporate buoyancy modules at specific locations, which impose uplifting forces on the riser thus reducing both the hang-off tension and the seabed stiffness degradation due to the motion of floating facility [2]. Inclusion of the buoyancy modules can also assist in controlling the distance between the floating facility and the wellhead. In order to perform a proper riser design one has to perform a proper riser configuration analysis.

In the present study, we propose a simple technique for riser configuration analysis, which accounts for the buoyancy modules, nonlinear seabed stiffness at the touch down point, and other environmental loading such as drag forces applied by the sea water and its level changes. The solution is based on finite difference discretization of nonlinear beam equations, which account for large deformations of the riser [3]. The whole riser is treated as a single, continuous segment. Pipe-soil contact condition allows for irrecoverable plastic deformation of the seabed with stiffness degradation due to cyclic motion.

Several examples with different riser configurations are provided to demonstrate the performance of the method. Sensitivity studies to emphasize the effect of buoyancy modules and soil stiffness degradation were performed.

## REFERENCES

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