99/101
Deepwater SCR comparison with Flexcom[1]

1 Introduction

An independent consultant set up and ran Flexcom and OrcaFlex models of a 12in steel catenary riser (SCR) supported by a semisub host vessel in 6000ft (1800m) of water. The models represent typical SCR designs for Gulf of Mexico or West Africa conditions. Typical Extreme and Fatigue Waves were analysed both as regular and irregular sea states.

2 Input data

The case chosen for the comparison was meant to be representative of typical deepwater Gulf of Mexico condition. In particular a very heavy wall thickness pipe was used and an above normal stiff seabed was assumed in order to try and induce chatter and model instability.

Water Depth	1,800 m
SCR length	2,765 m
OD	0.308 m
Wall thickness	0.027 m
Material density	7.85 te/m^3
Contents density	0.8 te/m^3
Young's modulus	210,000 MPa
Poisson ratio	0.3
Normal drag coefficient	1.2
Normal added mass coefficient	1.0

Table 1: Summary of input data

The OrcaFlex and Flexcom models used element lengths of 5m, apart from a 300m section around the TDP which used 1m elements.

The comparison considered some cases with a high seabed stiffness value of 2,400kN/m/m and other cases with a lower seabed stiffness value of 240kN/m/m. These values are quoted in Flexcom units – the equivalent OrcaFlex values are 7,792kN/m/m^2 and 779.2 kN/m/m^2 respectively.

3 Results comparison

The independent consultants concluded that "The models running in both Flexcom and OrcaFlex ran stably throughout the tests. Initial benchmarks showed the programs produced very similar engineering results well within any accuracy tolerance expected."

This agreement is illustrated by the following comparisons of statics and dynamics results:

[1] Flexcom is a nonlinear, time domain, finite element program which is developed and owned by MCS, Galway Technology Park, Parkmore, Galway, Ireland.

	Flexcom	OrcaFlex
Effective Tension at End Connection (kN)	697.6	697.0
Effective Tension at Hang-off (kN)	3345.5	3340.5
Moment at Touchdown Point (kNm)	105.0	104.9
Shear at Touchdown Point (kN)	10.2	9.24
Touchdown Element No.	218/219	217/218

Table 2: Comparison of Statics Results

Comparisons of both regular and irregular wave cases were performed with excellent agreement in all cases.

The graph below shows the extreme bend moment plotted along the length of the riser for a linear regular wave with height 20m and period 15s.

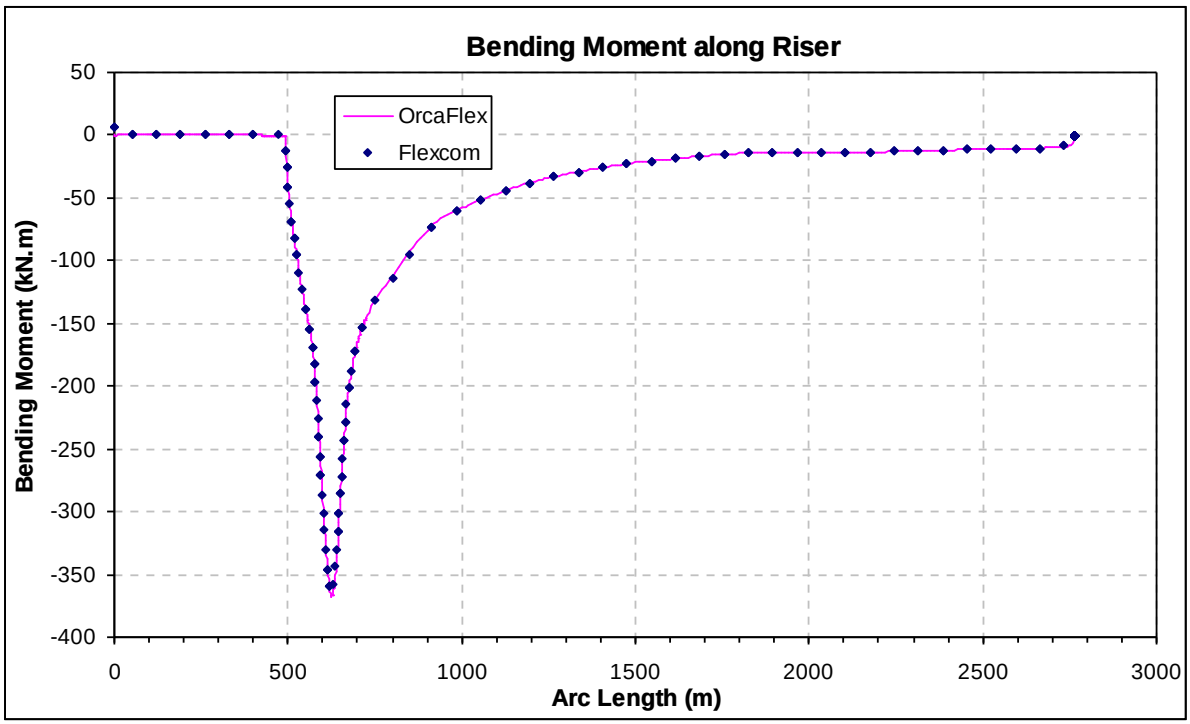

Figure 1: Comparison of Dynamic Bend Moment Results

The graph below shows time histories for effective tension at the riser top end, this time for an irregular wave case with H_s=15m and T_z=11s. Again the results from the two programs are almost indistinguishable.

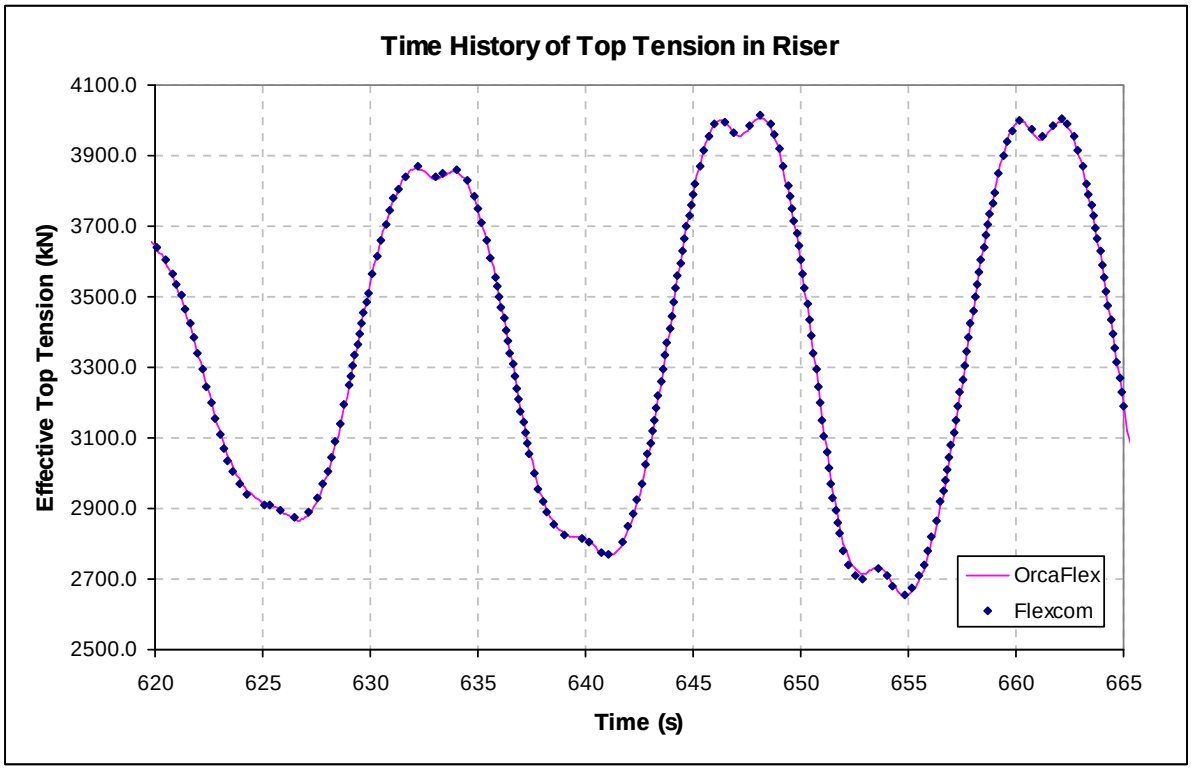

Figure 2: Comparison of Top Tension time histories

4 Effect of element length on accuracy

The independent consultants also ran OrcaFlex and Flexcom using different element lengths in the touchdown section of the riser, in order to study the effect of element length on the results. They concluded "Sensitivity on element length was performed for the regular extreme wave, using 2m, 1m, 0.5m and 0.25m elements at the touch-down point. The results showed that the moments predicted by OrcaFlex produces at least as good results for the same element sizes as Flexcom."

This is illustrated by the following graphs showing the effect of element length on the results from OrcaFlex and from Flexcom.

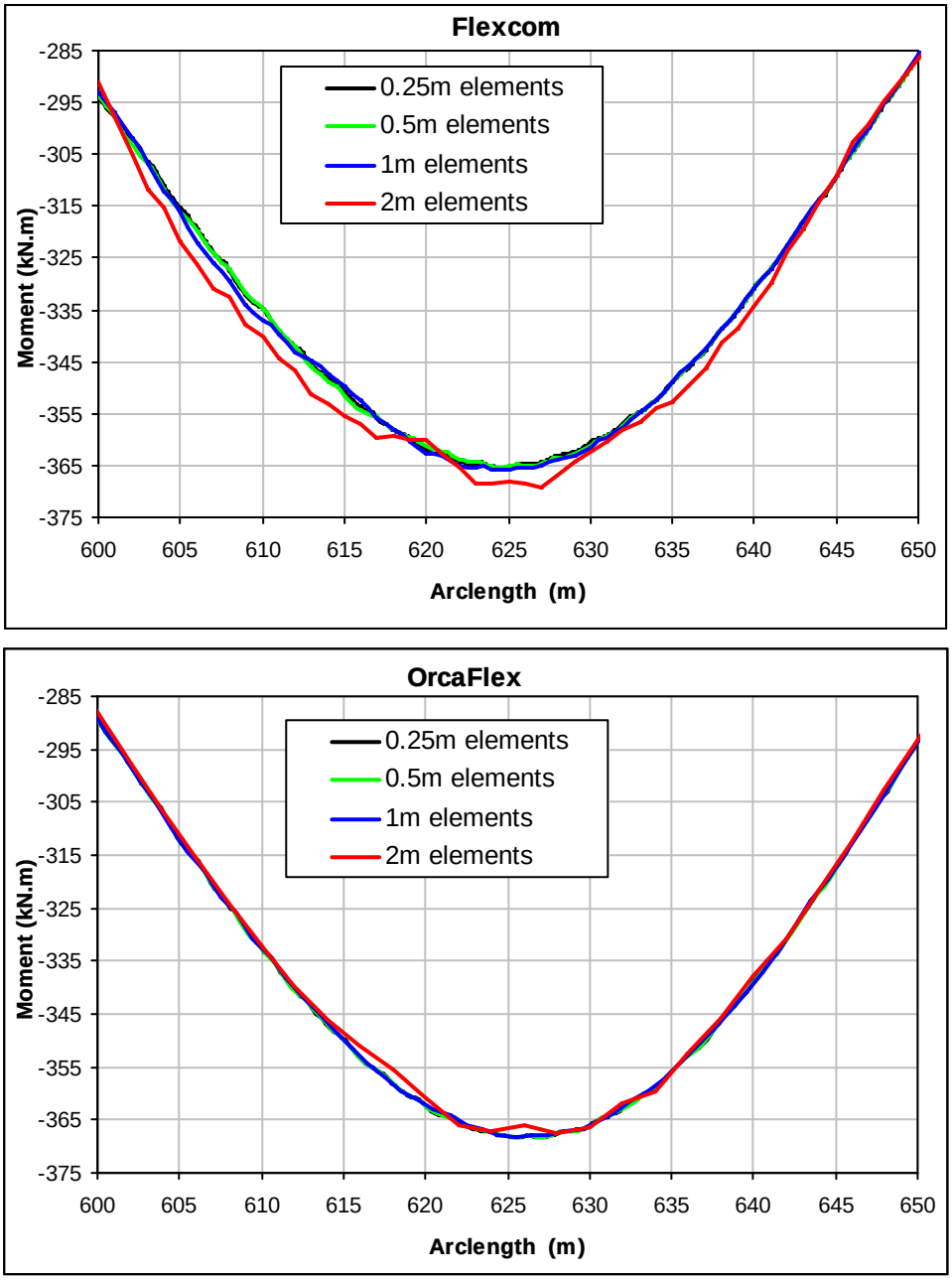

Figure 3: Effect of element length on bend moment near touchdown

5 Conclusions

The independent consultant modelled a typical Gulf of Mexico deepwater SCR in both Flexcom and OrcaFlex. Excellent agreement between the results from both programs was achieved for statics, regular wave dynamics and irregular wave dynamics. It was also found that similar element lengths are required for both OrcaFlex and Flexcom to achieve results of comparable accuracy.