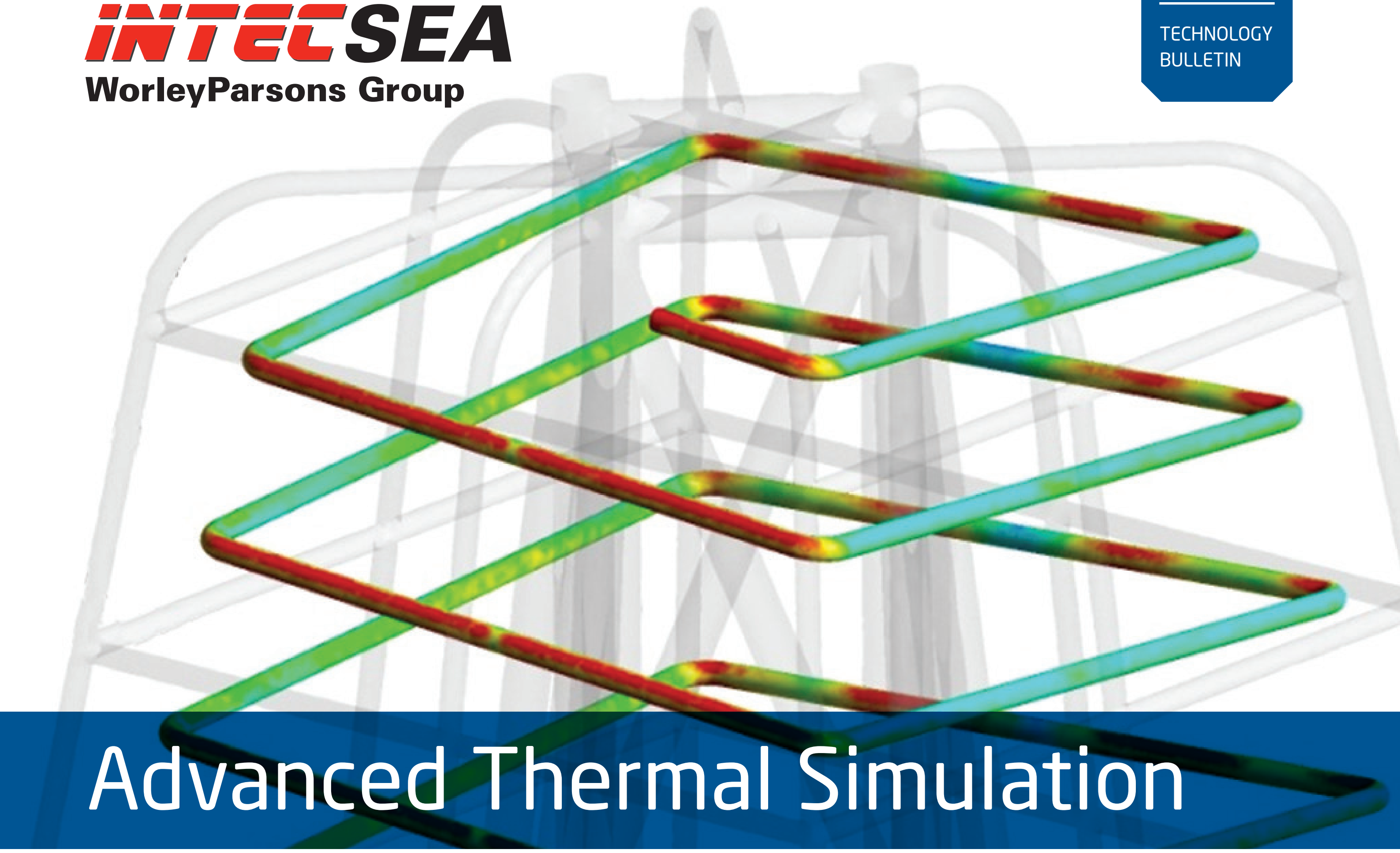
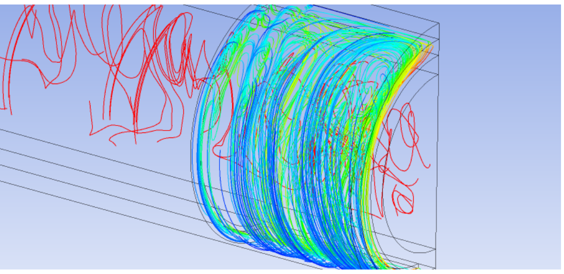
INTECSEA
WorleyParsons Group

TECHNOLOGY BULLETIN



Advanced Thermal Simulation



Customer Benefits

- Identify cost savings thanks to optimisation of components and designs at early stages of projects
- Fosters innovation by shortening the product development process through virtual modelling
- Reduce risk by predicting the performance of systems incorporating complex geometry
- Ensure equipment integrity, safety and reliability through detailed analysis
- Meet design challenges that are outside industry codes and standards

Introduction

The wide range of Advanced Analysis services provided by INTECSEA includes Advanced Thermal Simulation. Our engineers have extensive experience in heat transfer related problems and develop numerical models using the ANSYS and ABAQUS software to help customers meet their engineering challenges and deliver innovative design solutions.

INTECSEA has applied Computational Fluid Dynamics (CFD) and Finite Element Analysis (FEA) to predict the thermal performance of all kinds of subsea assets, including offshore pipelines, subsea structures and marine risers.

Through the realistic simulation of complex heat flow patterns and temperature distributions, INTECSEA has helped customers to reduce the conservatism and the cost of traditional design solutions without compromising safety and reliability.

Modelling Capabilities

- Thermal conduction, convection (natural and forced) and radiation
- Steady-state and transient thermal simulations
- Conjugate heat transfer
- Coupled thermal-fluid dynamics analysis for internal and external flows
- Coupled thermal-structural analyses

The application of advanced thermal simulation to all stages of oil and gas projects has allowed our customers to effectively manage the performance and the safety of their assets where a detailed knowledge of the temperature distributions and heat transfer mechanisms is required.

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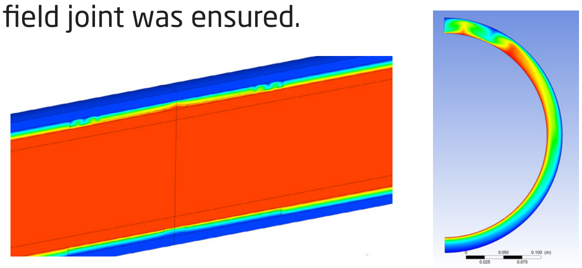
Case Studies

Project: BP Angola Block 31 PSVM

Partial insulation at field joints could arise “cold spots” that might affect the thermal performance of the subsea pipe-in-pipe system. A transient coupled thermal-fluid dynamic simulation was set up to estimate the fluid temperature at the end of the cool-down process. The predicted minimum fluid temperature was compared against the temperature of hydrate formation and the thermal performance of the partially insulated field joint was ensured.

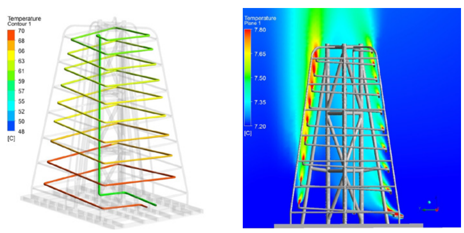


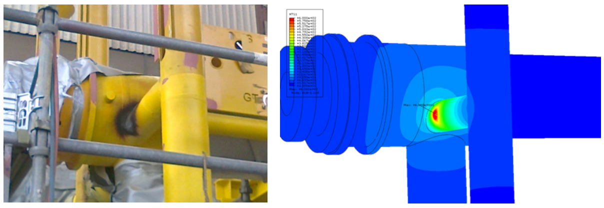
Project: Woodside Western Australia Cimatti Development

The objective of the study was to determine the thermal performance of a subsea cooling spool for a range of seawater current conditions to assist with the design.

A single spool design was investigated through Computational Fluid Dynamics (CFD) under free and forced convection conditions.

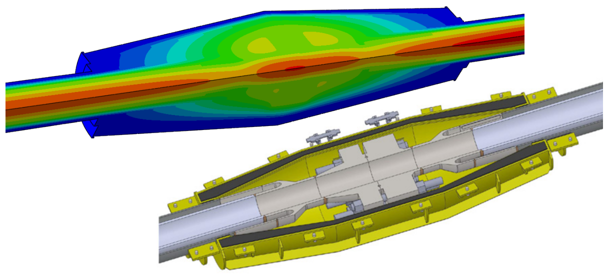
Simulations showed increased heat transfer coefficient values on higher spool loops due to free convection, and increased heat transfer coefficient values on spool sections open to oncoming flow in forced convection. Calculated heat duty values suggested the spool provided sufficient cooling when compared to required heat duty values.





Project: BP Angola Block 31 PSVM

Remediation work executed during construction for a subsea structure involved the application of thermal loadings that could potentially affect the integrity of insulation layers. Through the transient simulation of heat-up and cool-down processes it was possible to verify the integrity of the internal insulation within a very short timeframe and no remediation work was deemed necessary, thus achieving significant cost savings for the construction phase.



Project: ExxonMobil Nigeria DeltaAfrik

The thermal performance of complex subsea insulation systems was verified at the early stages of the design through steady-state and transient thermal simulations. A detailed distribution of temperature across the components of the insulation assembly was predicted to ensure that no cold spot occurs at the junction of two adjacent subsea pipeline sections.

Publications

OMAE 2013-10812: Cool-down Time Estimation Through Numerical Analysis for Partially Insulated Offshore Pipe-in-Pipe Field Joints
Luca Chinello, Philip Cooper, Ramon de Haas, Helen Boyd

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