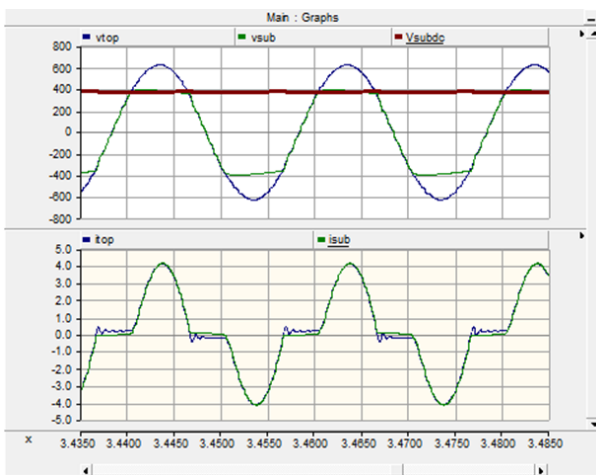


Use of high-power electric motors for running subsea pumps and compressors is on the rise, and more traditional subsea systems are becoming more complex in terms of extended step-out lengths, increased number and power consumption of subsea nodes, and superimposed signal communication at higher frequencies.

At Unitech Power Systems we are experienced in all related electric power analyses required to ensure power system/supply functionality, including long step-out motor drives. Although there are as yet no subsea power distribution systems in existence, we have all related system know-how in-house.

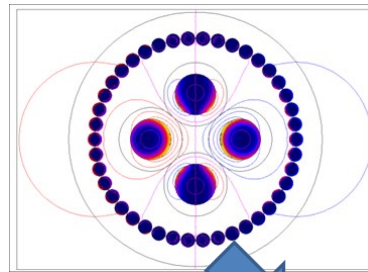
Subsea control system analyses would typically include power supply, and basic signal analysis for impedance matching, attenuation and signal-to-noise ratio (SNR) considerations. Control system loads are typically non-linear, as exemplified in the figure below. The most detailed studies are typically made with time-domain software, like PSCAD/EMTDC.



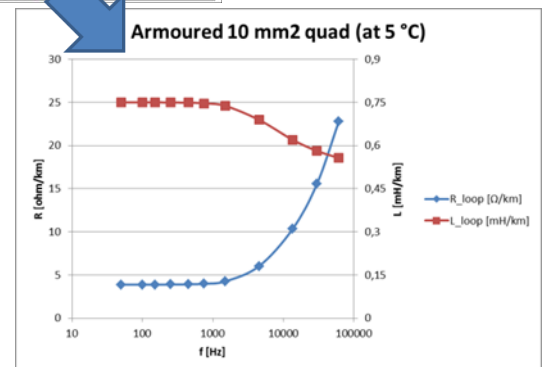
High-quality electric parameters of subsea cables and (power) umbilicals are key input data to any successful subsea power system analysis. Our personnel have in-depth experience from several years of modeling such cables/umbilicals, including full-scale measurements for model verification. Developed modeling techniques are known to result in highly realistic, computed parameters.

Flux 2D is a finite element tool made for electromagnetic analysis from the set-out. This software is extremely well suited for analysis of cables and umbilicals, with the purpose of extracting electric parameters close to real-life values.

Frequency dependent cable parameters are easily computed with Flux 2D, as illustrated below.



Flux 2D (finite element) model used to extract parameters (resistance and inductance) of armored quad well into the kHz-range



“Typical” subsea high-voltage/high-power consumers:

- Fixed or variable speed motor drives, possibly long-step-out, and/or multiple power circuits per cable/umbilical
- Subsea pipeline flow assurance by electrical heating: Direct Electrical Heating (DEH), or Electrical Trace Heating (ETH)

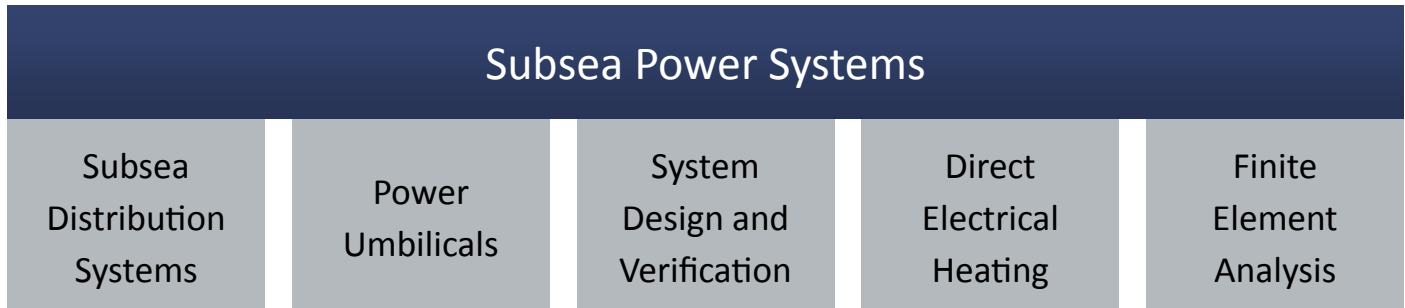
The world of subsea engineering is generally multi-disciplinary, particularly with respect to electric power. For example, small phase-imbalance effects in the power system might have a huge impact on corrosion aspects. Electromagnetic crosstalk, neutral earthing philosophy, and coupled electro-thermal considerations and analyses are only examples of issues to be addressed during system design/definition.

Our personnel has in-depth experience with engineering for subsea power projects since the mid-1990s, as well as massive experience with subsea cable and umbilical design and manufacturing. Contact us for more information and to discuss how we can serve your needs.

Contact person:

Arild Larsen
 Sales and Marketing Manager
 E-mail: larsen@unitech.no
 Phone: +47 932 26 425

Technology and application areas



Selected project references

Year: 2012-2013
Customer: JP Kenny/Shell

Linnorm FEED SURF study

Responsible for all DEH related activities during the FEED study for the Linnorm subsea development, including evaluation of DEH sub-system suppliers. Linnorm was planned as a subsea development with tie-back to the Draugen platform.

Year: 2012-2013
Customer: UltraDeep/Shell

Bonga SW/ Aparo subsea control power and signal transmission

Define-stage subsea production control system analysis. Calculation of umbilical's electric parameters. Identification of worst cases and detailed analysis of control power supply and signal transmission. Short circuit calculations for power supply system. Quantification of attenuation in signal transmission.

Year: 2013
Customer: UltraDeep/Petrobras

Subsea separation studies

Analyses of subsea pump power supply systems.

Year: 2014-2015
Customer: ConocoPhillips

Tommeliten Alpha flowline heating

Advisory services on technology qualification for subsea pipe-in-pipe flowline electrical trace heating (ETH).

Year: 2015
Customer: Shell

OrmenLange control power supply

Analysis of redundant control power supply system configuration and power loss. 120 km step-out from shore to subsea templates. Comparison with measurements.

Measurement of onshore UPS current waveforms.