# VIVANA

## **Application areas:**

VIVANA is a computer tool for calculation of vortex induced vibrations (VIV) of slender marine structures such as risers, free span pipelines and cables subjected to ocean current. This response type may in many cases be decisive for the design and operation of marine systems.

Depending on the length of the structure and cross section and current velocity variations, one may experience single- or multi-frequency response. VIVANA is able to handle both response types, but is at present limited to compute vibrations orthogonal to the current velocity. Hence, in-line VIV is not considered.

## **Method:**

The hydrodynamic model in VIVANA is based on empirical coefficients, while the structural model applies a non-linear 3-dimensional finite element formulation. The program is able to work with an arbitrary distribution of tension, mass, stiffness, buoyancy and diameter. Response frequencies are identified while considering a frequency dependent hydrodynamic mass along the structure. Response amplitudes are calculated at the discrete frequencies by the frequency response method. The excitation force model includes a lift coefficient that is a function of the response amplitude and the response frequency. Damping outside the excitation zone is introduced by high and low velocity damping terms.





#### **Program capabilities:**

Examples of riser systems that can be analysed by VIVANA are shown above.

Important VIV properties handled by VIVANA are:

- Free variation of all parameters (diameter, Strouhal number, coefficients etc.) along the riser
- Frequency dependent hydrodynamic mass matrix
- Identification of dominating and possible response frequencies
- Identification of excitation and damping zones for all response frequencies
- Calculation of response amplitude
- Calculation of fatigue damage
- Calculation of drag amplification

#### Functionality:

The VIVANA program system currently includes the following functionality:

- RIFLEX INPMOD: Reads riser model data from a user defined input file.
- RIFLEX STAMOD: Calculates the static equilibrium condition for the riser
- VIVANA: Main VIV module; computes VIV response, fatigue damage and drag amplification

A complete user interface for VIVANA does not exist at present, but a Windows based environment for running the various modules and viewing result plots is available.



# MARINTEK

Division of Offshore Structures P.O.Box 4125 Valentinlyst N-7450 Trondheim, NORWAY Phone: +47 7359 5900 Fax: +47 7351 0034 http://www.marintek.sintef.no E-mail: vivana@marintek.sintef.no



Norwegian University of Science and Technology Faculty of Marine Technology 7491 Trondheim, Norway http://www.marin.ntnu.no