MARIN

Challenging wind and waves

Linking hydrodynamic research to the maritime industry

## Analysis of propellers

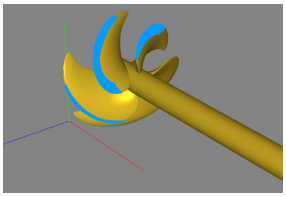
# ANPRO

The ANPRO software package encapsulates a series of propeller analysis tools. These tools are built around a reliable and robust lifting surface method for the computation of the quasi instationary blade loading of a propeller in a ship's wake field. Due to its excellent computational performance ANPRO is extensively used for propeller designs at MARIN. With this tool experienced propeller designers are able to make a well-balanced design regarding propeller efficiency and harmful cavitation types such as pressure side cavitation and isolated cavitation patches.

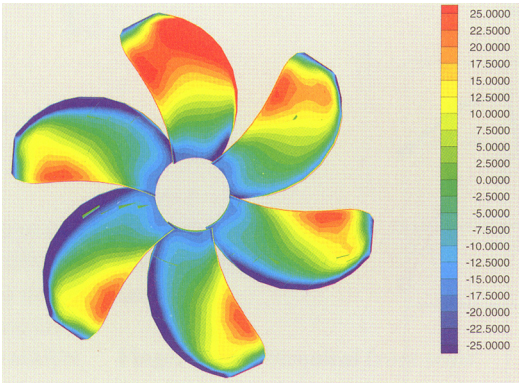
### Output

Based on an input of propeller geometry, wake field components and operational parameters like speed, RPM and cavitation number ANPRO can provide the user with:

- Propeller open water characteristics.
- Behind-ship propeller characteristics ( thrust, torque).
- Cavity type and extent on a propeller blade at various positions in the wake field and calculation of the pressure distribution over a blade at various positions in the wake field.
- Preparation of the loading and geometric data which can be used in a finite element propeller strength.
- Analysis (supported third-party software is ANSYS©).
- Modification of the propeller geometry: scaling of the dimensions and changing the pitch angle.
- Modification of the wake field: scaling of the dimensions of the radial co-ordinates and scaling of the axial velocity component.



*Calculated cavitation patterns*




*Blade pressure at pressure side in kPa*

### Cavitation patterns

The cavitation occurrence is calculated in order to obtain information on the existence of blade angle dependent bubble and sheet cavitation on both sides. The extent of sheet cavities is also calculated.

### Stress distribution

The propeller blade stresses can be calculated using third-party software on the basis of ANPRO results (currently only interfacing for ANSYS FEM software). Typical conditions offering useful information about the combined equivalent blade stresses (Huber-Hencky-von Mises) are: the mean wake, the angular position where the unsteady thrust is at its maximum and the backing bollard condition as a measure for the stress level during backing action.

Future developments will provide functional improvements such as process automation tools in combination with Quaestor/ MS Excel.


For more information please contact the Maritime Simulation & Software Group;

T +31 317 493 237

E msg@marin.nl


V. 2010/05/06_MSG Soft. 13


MARIN
P.O. Box 28

6700 AA Wageningen
The Netherlands

T +31 317 49 39 11
F +31 317 49 32 45

E info@marin.nl
I www.marin.nl