

# aNySIM XMF

Time Domain Simulations for Multi Body Dynamics for Offshore Operations



## Available modules

At present the following modules are available in aNySIM XMF:

- Linear and non-linear hydrostatics
- Wave forces (1st and 2nd order)
- Coefficient based current loads and wind loads
- Wave radiation including hydrodynamic interaction between bodies
- Morison loads on slender structures and plates
- Spring lines, catenary lines and lumped-mass lines
- Winches
- Fenders
- Joints
- Propellers, rudders and thrusters
- DP controllers
- Kalman filter

Multi-body time domain simulation tool

aNySIM XMF is the time domain simulation software for offshore applications (negligible forward speed). The response of the (floating) bodies due to mechanic and hydrodynamic forces is calculated in (fast) time simulations. aNySIM XMF is suitable for analysis of terminal availability, operability of lifting operations, dynamic positioning performance, mooring fatigue, and more.

MARIN has been developing, using and selling hydrodynamic simulation software for many decades. Well-known predecessors of aNySIM XMF are TERMSIM, LIFSIM, DPSIM, DREDSIM and DYNFLOAT.

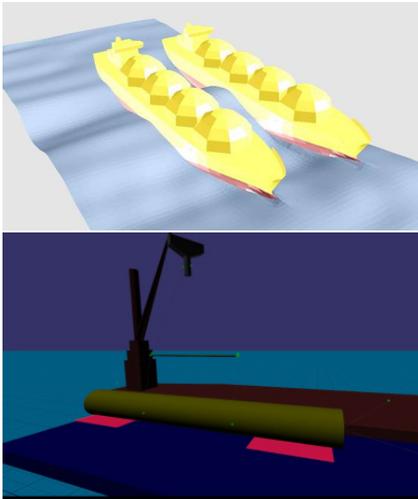
aNySIM XMF is used by engineering companies, oil companies, ship yards, consultants and contractors. MARIN also uses aNySIM XMF for most engineering studies at zero or low speed.

The modular structure of aNySIM XMF makes it possible to combine the different functionalities. This way you can also model more complex configurations. For example:

- Turret moored FPSO in changing weather conditions
- Offloading from a CALM buoy
- Lifting of a jacket structure with a crane vessel keeping position by using a Dynamic Positioning (DP) system
- Monopile installation with a motion compensated pile gripper
- LNG bunkering of a cruise vessel
- FLNG on a soft yoke in short crested wave conditions
- ... or a combination of the above

## Documentation and user guidance

The modular approach of aNySIM XMF is key value of the software. To ensure continuous flexibility there is no sophisticated user interface. Instead basic tools for configuration, visualisation and monitoring are supported. Furthermore a tutorial, theory documentation and property information is available and updated with every release.



## Input

Input parameters:

- Geometry, inertia and stability
- a (multi-body) hyd-file resulting from diffraction analysis
- Wind, wave and current
- Method for station keeping

## Output

Time traces and basic statistics for different properties, for example:

- vessel motions
- crane tip motions
- mooring loads
- fender forces

For more information contact the MARIN Software Group

T +31 317 49 32 37

E [msg@marin.nl](mailto:msg@marin.nl)

## Extensible Modelling Framework (XMF)

aNySIM XMF is part of MARIN's Extensible Modelling Framework (XMF). XMF is a C++ software toolkit on which all MARIN's fast-time and real-time simulation software is based.

The XMF system reads the model from the file, loads the related dynamic content libraries and starts executing a fast-time, or scaled wall-clock time simulation. The XMF core libraries focus on reusability, extensibility, object interoperability, I/O and Newtonian dynamics.

The shared computational core of XMF makes it easier to switch between a fast-time engineering study and a real-time operational training on the bridge simulator.

## Computational approach

The mathematical model is based on a time-step solution of the system of coupled differential equations of motion. Rigid body motions are assumed. Vessel specific results from linear diffraction calculations, consisting of frequency dependent wave forces, added mass and damping are typically used to model the hydrodynamics. The impulse response method is applied to determine the time domain response based on the frequency domain transfer function. Depending on the application one of the available generic solvers is used to solve the equations of motions.

## User defined scripting

aNySIM XMF offers an interface through which external subroutines can be called. In this way the user can extend the functionality of aNySIM XMF by developing additional modules in LUA or python. This can for example be used for prototype development or coupling to other software.

## Verification, Validation and Benchmarking

Reliable physics modelling is the main objective of aNySIM XMF; validation and verification are an essential part of the development. aNySIM XMF was developed by implementing the functionalities step by step making sure that every step is verified and benchmarked against analytic solutions, (model) tests results or other simulation software.

## aNySIM<sub>pro</sub> and aNySIM User Group

A project based version of aNySIM XMF is available. Further information about the possibilities can be found in the aNySIM<sub>pro</sub> leaflet.

Often, after a few of those project based aNySIM<sub>pro</sub>'s in which MARIN prepares the initial set-up, the user decides to become a member of the aNySIM User Group. Members of the User Group express the intention to be long-term users. During User Group Meetings experience is exchanged and future developments are discussed. The User Group has a voice in the course of the developments. Current members are Bluewater, GustoMSC, Heerema, Royal Haskoning DHV, Saipem and Shell.