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Assessment of line and fender loads for moored tankers 油船系泊时缆绳和护舷材载荷评估

aNyMOOR.TERMSIM

aNyMOOR.TERMSIM is a time domain simulation program to analyse the dynamic behaviour of a moored export tanker subject to wind, waves and current. The mooring system can be a Single Point Mooring (SPM), a Multi Buoy Mooring (MBM) or a jetty terminal. The program predicts the mooring loads and tanker motions when the system is exposed to operational environmental conditions.

aNyMOOR.TERMSIM 是一种时域仿真程序，用以分析风浪流环境下油船系泊时的动力特性。系泊系统可以是单点系泊，多点系泊或者是码头系泊。该程序可预报系泊系统运营环境下的系泊载荷和油船运动。

aNyMOOR GUI aNyMOOR 用户界面

aNyMOOR.TERMSIM is part of the new aNyMOOR suite consisting of:

1. aNyMOOR.TERMSIM
2. aNyMOOR.DYNFLOAT
3. aNyMOOR.SHUTTLE(not commercially available yet)

aNyMOOR.TERMSIM 是新版 aNyMOOR 的其中一个模块，新版 aNyMOOR 包括以下几个模块：

1. aNyMOOR.TERMSIM

2. aNyMOOR.DYNFLOAT

3 .aNyMOOR.SHUTTLE(暂不对外提供)

aNyMOOR is basically a versatile GUI which interfaces with our in-house simulation kernel aNySIM (for more information, see separate leaflet), incorporating the knowledge gained during several JIPs (such as SHUTTLE and DYNFLOAT JIP) and feedback from clients. aNyMOOR.TERMSIM focuses on time-domain simulations for offloading, mooring and terminal design. aNyMOOR.TERMSIM is easily extended with .DYNFLOAT or .SHUTTLE functionality by installing an extended license. The modular setup of the aNyMOOR program allows for additional aNySIM functionality in future releases.
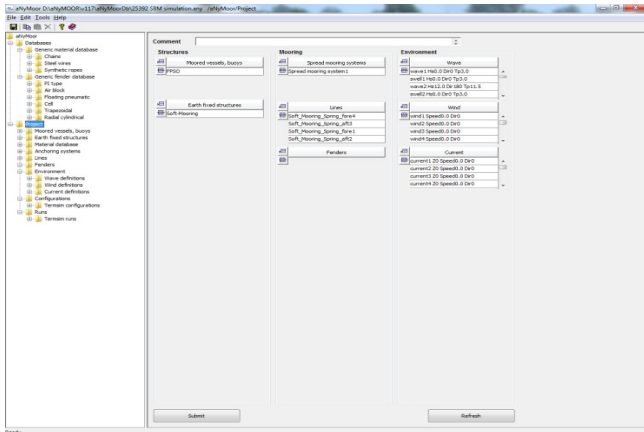
aNyMOOR 主要是一个多功能的图形用户界面与我们内部仿真内核 aNySIM 接口（更多信息，参阅单独的介绍），结合了多个联合工业项目（例如 SHUTTLE and DYNFLOAT JIP）中获得的知识以及用户的反馈。aNyMOOR.TERMSIM 针对卸载、系泊和码头设计的时域仿真。通过安装扩展许可证，aNyMOOR.TERMSIM 可以很方便的扩展并入.DYNFLOAT 或者.SHUTTLE 的功能。aNyMOOR 程序的模块化设置允许在以后版本中增加额外的 aNySIM 功能。

The input of data is user-friendly and is performed by the GUI in different nodes following a certain workflow. Each node can be seen as a separate building block. The input starts at the project-node where all required nodes are easily generated. At the end of the workflow all building blocks are put together in the configuration panel. By using this workflow different configurations can quickly be built. To even further speed up the project, all nodes can be copied and modified. The copy and paste action is also possible from and to Excel into tables.

数据的输入非常容易，按照一定的工作流程在不同的节点上通过图形用户界面执行操作即可。每一个节点可视为一个独立的构件。输入从项目节点开始，之后便很容易产生所需的所有节点。在工作流程的结束段所有构件被装配在配置面板上。通过使用这种工作流程可以迅速建立起不同的配置。为了进一步加快项目的建立，所有节点都可以进行复制和修改。从 Excel 到表格之间的复制粘贴也是可以的。

The system layout is represented graphically in a schematic format to detect input errors in an early stage.

在早期阶段以图解形式展现系统布置图，以检测存在的输入错误。

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Below a summary is given of the most important input nodes:

以下简要列出最重要的输入节点：

Moored vessels and buoys 系泊的船舶和浮标

The software contains the OCIMF tanker database with hydrodynamic data for several tankers. A selected tanker can be scaled to the required dimensions. On request the database can be extended with dedicated vessels on project basis.

该软件包含了 OCIMF 油轮数据库中多艘油船的水动力数据。选择一艘油船后可缩放到所需要的尺寸。根据要求，在项目基础上数据库可扩展到特定船舶。

Besides the hydrodynamic database, a database with OCIMF wind and current data is provided. This database contains non-dimensional wind and current force/moment coefficients for use in the calculation of wind and current loads on a tanker.

除了提供水动力数据之外，也提供 OCIMF 风和流的数据。该数据包含无因次化风和流的力/力矩系数，以用于计算作用在油船上的风和流。

Material and fender database 材料和护舷材数据库

Defining the lines and fenders is an important aspect of a mooring system. Therefore, aNyMOOR.TERMSIM is provided with a material and fender database. The material database contains a large collection of chains, steel wires and synthetic ropes. These can be combined to define multiple legs, anchor lines or hawsers. The fender database contains typical fender types such as PI type, air Block, floating pneumatic, cell, trapezoidal and radial cylindrical.

User-defined material properties can be specified and imported into different projects through the drag and drop functionality.

定义缆绳和护舷材是系泊系统的一个重要方面。因此，aNyMOOR.TERMSIM 提供了一个材料和护舷材数据库。该材料数据库包含了大量收集的链、钢丝和合成纤维绳索。这些可以用来组合来定义多个桩腿、锚绳或缆。护舷材数据库包含典型的护舷材类型，例如 PI 类型、充气型、漂浮型橡胶护舷、鼓型、梯形和圆柱形。通过拖放功能用户可自定义材料属性输入到不同的项目中。

Anchoring systems 锚泊系统

Three types of terminals are considered:

三种类型系泊：

- **SPM** 单点系泊

  The SPM terminal consists of a conventional CALM buoy which is moored to the seabed by means of anchor lines. The tanker is moored to the buoy by means of a bow hawser. The CALM buoy is in this case a hydrodynamic object with all its particulars, similar to a vessel.

  单点系泊包含一种传统的通过锚线装置系泊于海床的悬链线锚腿系泊浮筒。油船被该浮筒通过弯曲的缆绳牵引着停泊。在这种情况下悬链线锚腿系泊浮筒就是一个包含其所有细节的水动力研究对象，类似于一艘船。

- **MBM** 多点系泊

  In a multi buoy terminal the tanker is moored by mooring legs consisting of an anchor line, a surface buoy and a hawser.

  在多点系泊系统中，油船的停泊是通过由锚线、浮体和缆索组成的多个桩腿牵引。

- **Jetty** 码头系泊

  For the jetty terminal the tanker can be moored by means of mooring legs and fenders. A mooring leg can consist of a number of parallel running, but equal lines.

  对于码头系泊，油船是通过系泊腿和护舷材的牵引方式停泊。一个系泊腿是由多个并联排布且等长的缆绳组成。
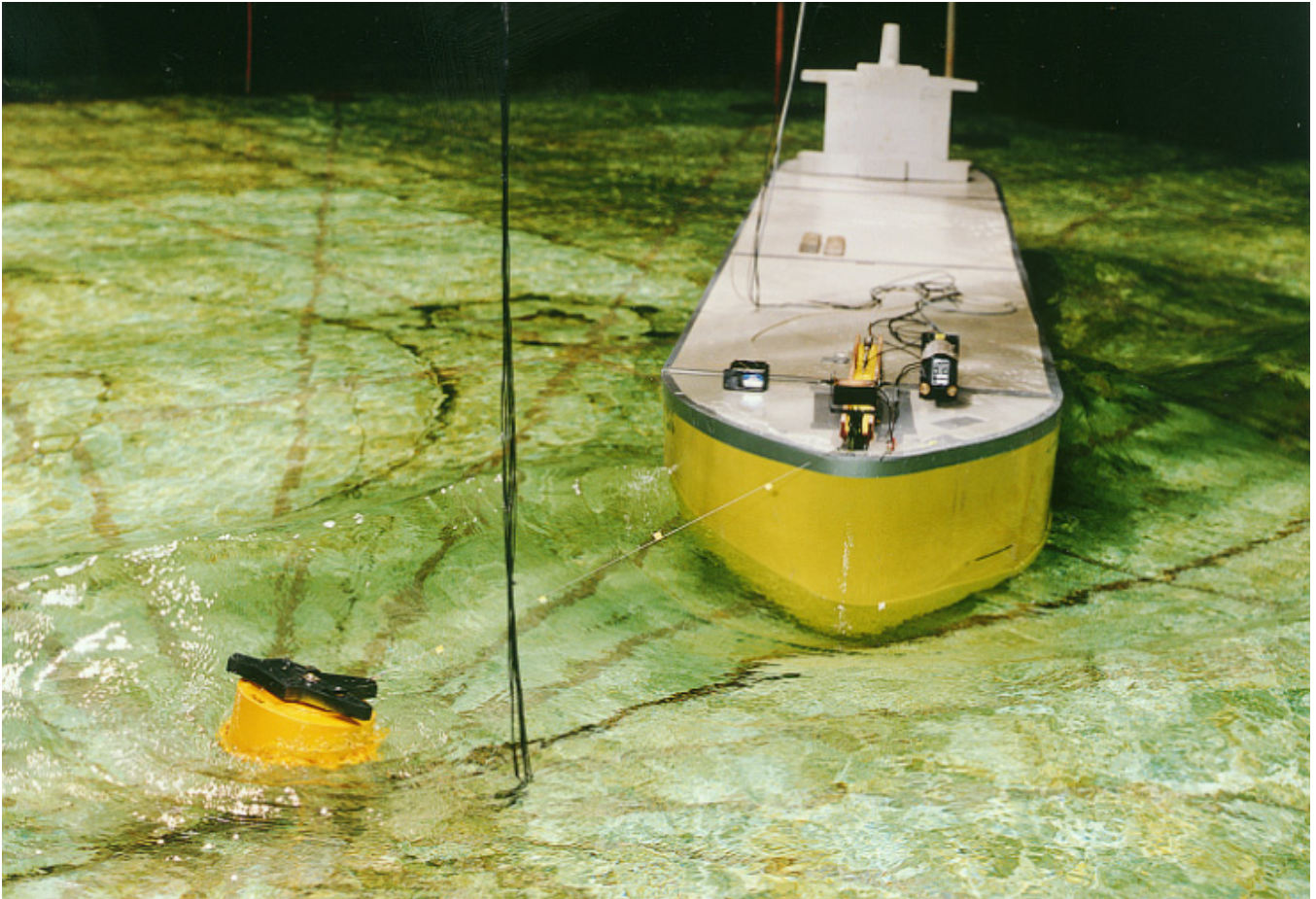
Environment 环境

The environmental conditions concern waves, wind and current. The waves can be defined as a theoretical spectrum (JONSWAP, Pierson-Moskowitz, Regular Wave, Gaussian or Torsethaugen), user-defined spectrum or as wave train time series. The wind can be defined as a theoretical spectrum (NPD, API, Ochi-Shin, Wills or Harris), user-defined spectrum or as time series. For each wave or wind condition a random seed can be applied. The current can be defined as fixed or changing. When fixed is chosen the current can consist of multiple layers each with their own speed, direction and depth. When changing is chosen one layer can vary in time, speed and direction. For each condition random seed can be applied.

环境因素是指风、浪和流。波浪可以被定义成一个理论波谱（ JONSWAP, Pierson-Moskowitz, Regular Wave, Gaussian or Torsethaugen），用户自定义波谱或者是波列的时间序列。风可以被定义成一个理论风谱（**NPD** 谱、**API** 谱、**Ochi-Shin** 谱、**Wills** 谱或者 **Harris** 谱），用户自定义风谱或者是时间序列。任意一种波浪或者是风的状态均可应用相应的随机模式。水流可被定义成固定的或不断变化的。当选择固定流之后，水流则由多个层组合而成且每一层都有自己的速度、方向和深度。当选择变化流之后，单层流在时间、速度和方向上都是变化的。对于任意一个条件都可应用随机模式。

Events 事件

The following events can be simulated:

- External forces (earth or vessel fixed)
- Line failures (breaks at a certain time and/or at certain load)

以下事件可以进行模拟：

- 外力（固定坐标系或随船坐标系）
- 系泊失效（在一定时间或一定的载荷下断裂）

Output 输出

The output of each simulation consists of an ASCII database containing all samples of the calculated signals. The signals include the tanker motions and accelerations at CoG, mooring loads in all mooring legs and other relevant quantities for the analysis of the mooring system behaviour. The Graphical User Interface presents all generated files, statistics, time traces and a 2D (bird's eye view) animations.

每次模拟输出由包含所有计算机信号样本的一组 **ASCII** 数据库组成。这些信号包括油船的运动和重心加速度、所有系泊腿上的载荷以及用于系泊系统分析的其它相关量。图形用户界面可提供所有生成的文件、统计数据、时间轨迹和二维动画（俯视）。

Validation 验证

In order to validate aNyMOOR.TERMSIM the three different systems have been simulated parallel with TERMSIM and aNyMOOR.TERMSIM. In case differences occurred, these were checked with model tests. A good correlation with the TERMSIM and the model tests was found.

为了验证 **aNyMOOR.TERMSIM**，采用三种不同的系统与 **TERMSIM** 和 **aNyMOOR.TERMSIM** 进行仿真比较。一旦发生偏差，可用模型试验进行核实。可以发现 **TERMSIM** 仿真和模型试验具有很好的相关性。

For more information please contact the department Maritime Simulation & Software Group;更多信息请联系海事仿真部门和软件组

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