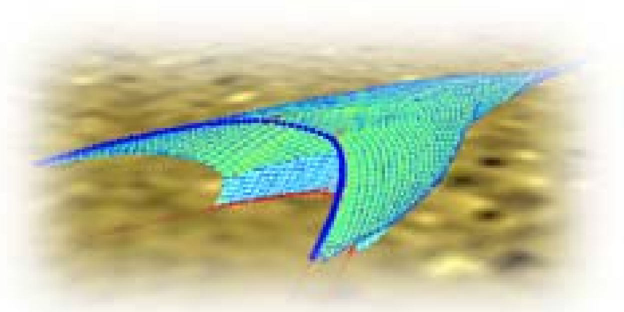
Exercises DynamiT



DynamiT

Ifremer

Training exercises for new users

1 Pieces of theory

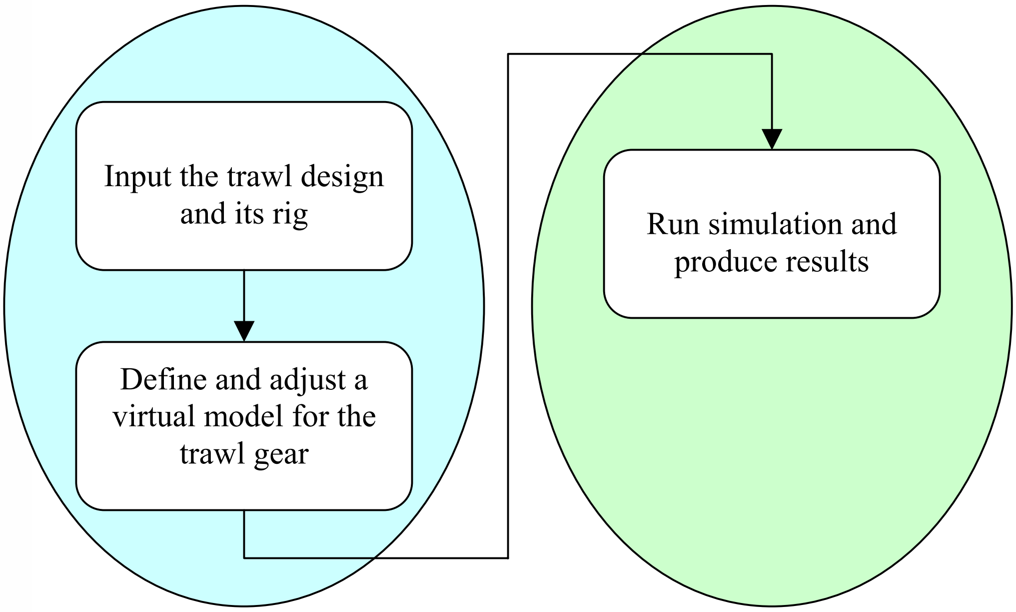
Index :

DynamiT

DynamiT deals with to types of documents :
Trawl Gear document which has a file extension TRG
Simulation document which has a file extension SIM
Only on TRG document can be open at a time.
Several SIM document can be open at a time.

Trawl Gear documents allow the user to input a trawl design. This part is simple for people who know trawls and have the basic Windows knowledge (popup menu, context menu …). The trawl Gear document also allows the user to define a virtual trawl that will be used by the simulation document to run calculations. This part may be more difficult, however users just have to follow simple rules to generate a proper virtual trawl.

In the simulation document the user runs calculations and analyze results. High quality pictures and video animations can also be produced inside this document.

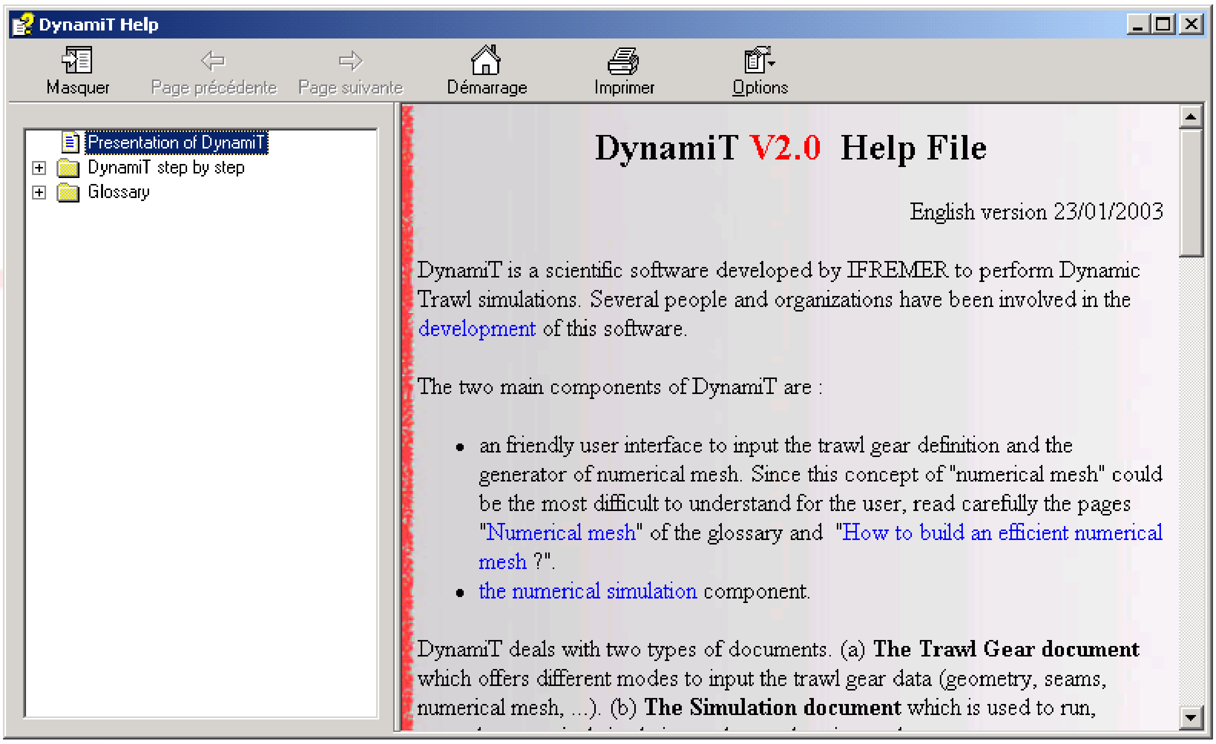


Trawl Gear Document

Simulation Document

DynamiT HELP

To get the DynamiT Help File just hit the F1 key. At any moment, you should get the contextual help corresponding to your current activity.



DynamiT Help also contain a glossary where current definition and some physical properties of common materials can be found.

DynamiT Help provides a “step by step” help for new users and details all dialogue boxes.

The numerical simulation

The numerical simulation is not able to represent all physical phenomena in details. The objects that are simulated (trawl gears of DynamiT for instance) and their behaviours are modelized, assuming some approximations because of the limits of the calculation devices and of our scientific knowledge.

Moreover, the errors produced by the calculation means, when attempting to solve the numerical problem, have to be added to these approximations.

However, all simulation methods have their own lack. Flume tanks for instance do not allow to represent the full trawl rig and do not facilitate the interpretation of the forces that are measured (when they are !) because of scale effects.

Measurements at sea, which are very expensive in terms of time and measurement devices, are always tainted with uncertainty due to the natural conditions that are almost never well known (under current, wind, swell …).

Finally, the numerical simulation provides global information (about geometry and forces) relative to the trawl gear for an affordable cost. But, above all, the numerical simulation allows to assess the effects of modification made on a trawl gear (modification of a length, of floatation, of a twine diameter, of a mesh size …) . It is especially in this way that DynamiT should be used.

The best way to use DynamiT, is to compare different numerical results together and not to consider a result as an absolute value.
As many physical effects are neglected by the numerical models, the user should know which trawl gear devices can be neglected and which are important.

Piece of theory relative to the net modelisation

Two major points, basis of the net modelisation, are discussed below :

The net twines are modelized with rigid and elastic bars. Each knot is modelized by a perfect knee joint (no friction, no elasticity in the join).

As a consequence, bars will have to be subdivided so as to represent the suppleness of twines. Rigidity of knots are not simulated : it would have consequences for the selectivity process in the codend (meshes opening), if the catch was modelized, but has no consequence for the global trawl gear shape .

The accuracy of material parameters (for netting especially) is very important : a mistake of 5% on twine diameters will imply a mistake of 5% on the net drag.

It is almost impossible to run a simulation from all the meshes of an actual net (trawl) : there are too many mesh sides, **except in cases where meshes are very big**, for midwater trawls for instance.

Thus, we are compelled to decreases the number of meshes that will be calculated. We call this process the globalisation.
The globalisation of the actual trawl meshes consists in replacing them with « virtual » bigger meshes so as to be able to lead a realistic calculation (fast enough).

Consequences :
There are many different virtual meshes that can be generated and used to run the simulation. All these virtual meshes are equivalent in terms of mechanic and hydrodynamics. They are also equivalent to the actual trawl mesh.

The user just has to choose the “fineness” of this mesh.
High fineness for accurate results (especially for the net shape)
Low fineness for fast results (especially for rigging adjustment)
A minimal fineness to respect (otherwise, bad results)
A maximal fineness to respect (computer and calculation duration limits).
DynamiT will automatically create a virtual mesh.

Practically :

The parameters of a « proper meshing » are :
A representative model of the net :
at least one mesh in the cod-end width,
at least two meshes in the wings width,
extend the corners of the square by a meshing line.
Optimising the calculation :
smaller a bar, at least 0.1 m in practice,
reasonable quantity of bars (1000 to 6000),
one intermediate knot on each mesh side.

(see also the tutorial “how to build an efficient virtual trawl”).

To respect these rules can be difficult, especially when using special configurations, for instance when using strengthening ropes inside a panel.

Example :

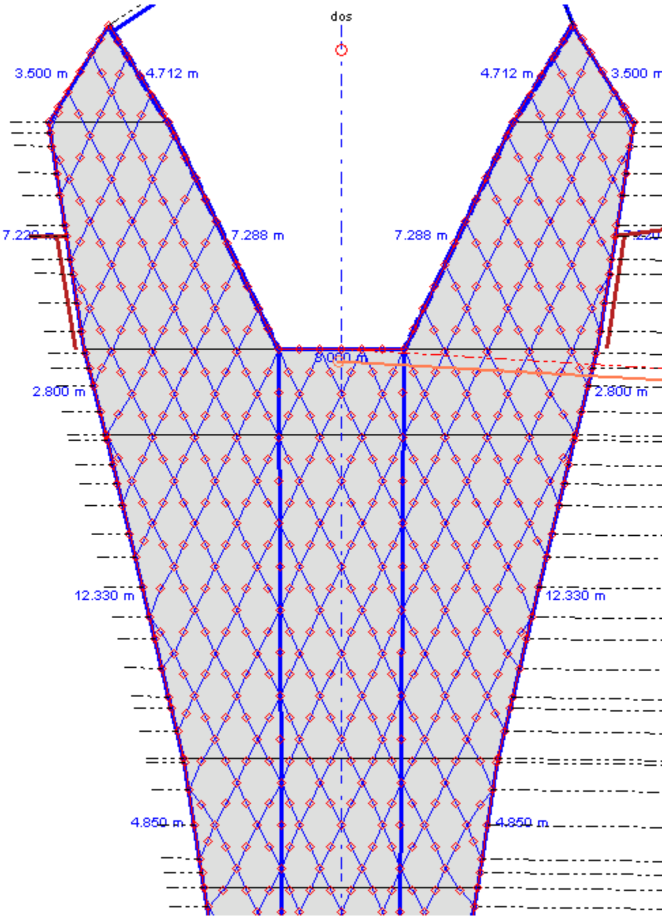
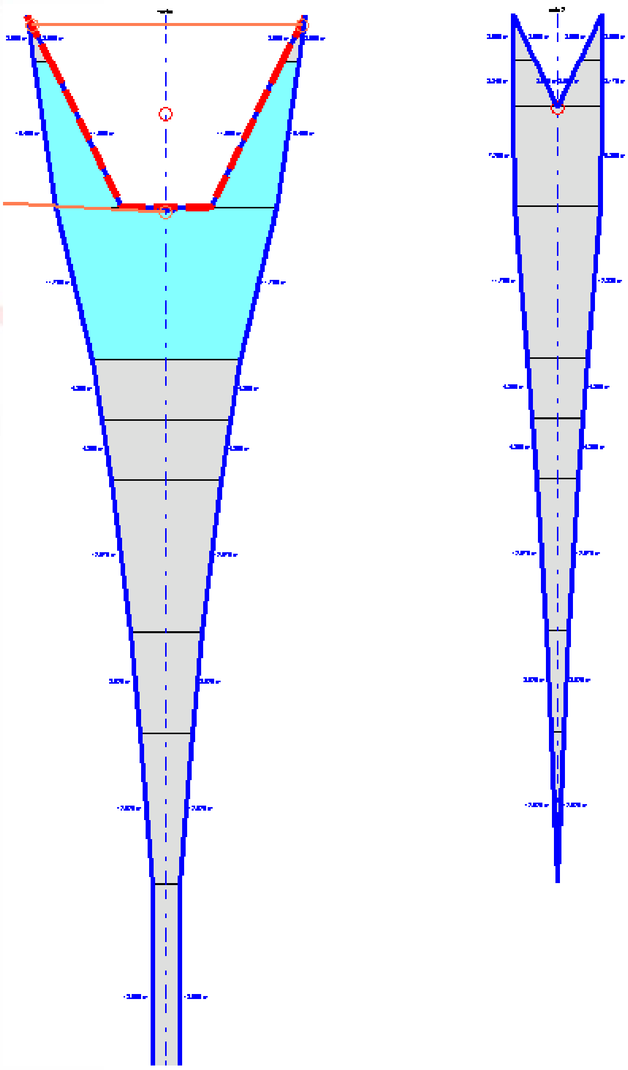


Fig. a

What is a panel regarding DynamiT ?

A DynamiT-panel is a continuous set of netting sections. Example :



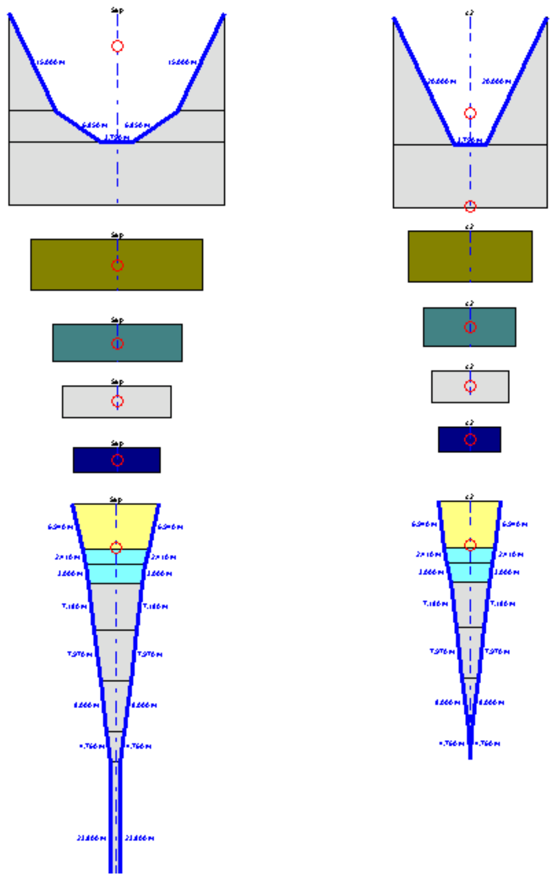


Fig. 1
These two sets of netting sections are 2 DynamiT-panels, because they are continuous.

Fig. 2
These two sets of netting section are not 2 panels but 12 DynamiT-panels.

Whatever the trawl you want to simulate, you can decide to define a DynamiT-panel only if a continuous virtual mesh can model the panel.

Example :

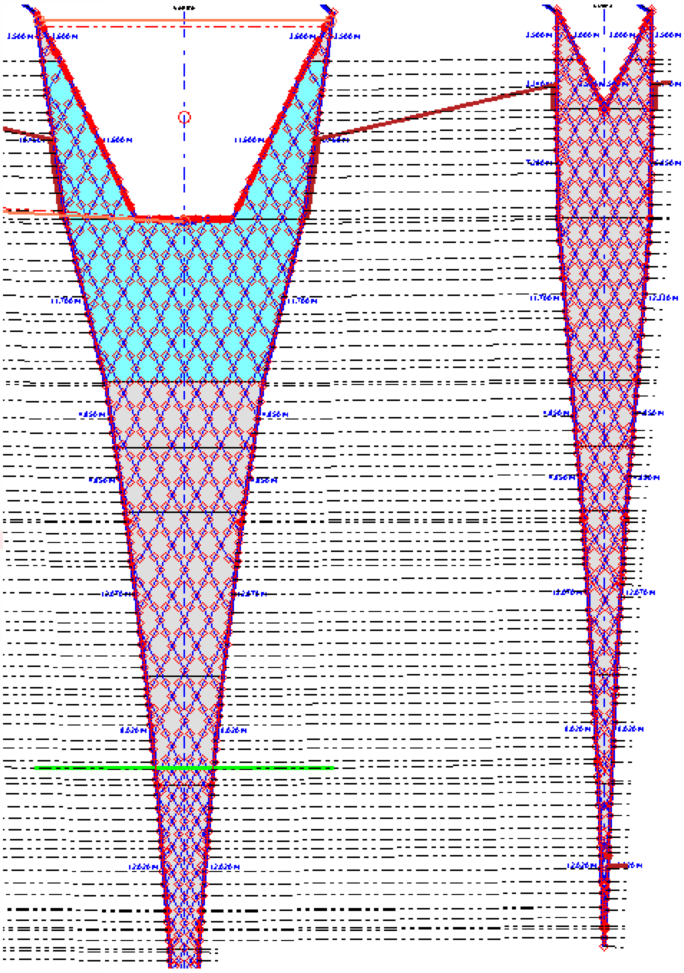


Fig. 3
You can define a single panel for each set of netting sections because the virtual mesh is continuous (same mesh side for each netting section, even in case of refinement).

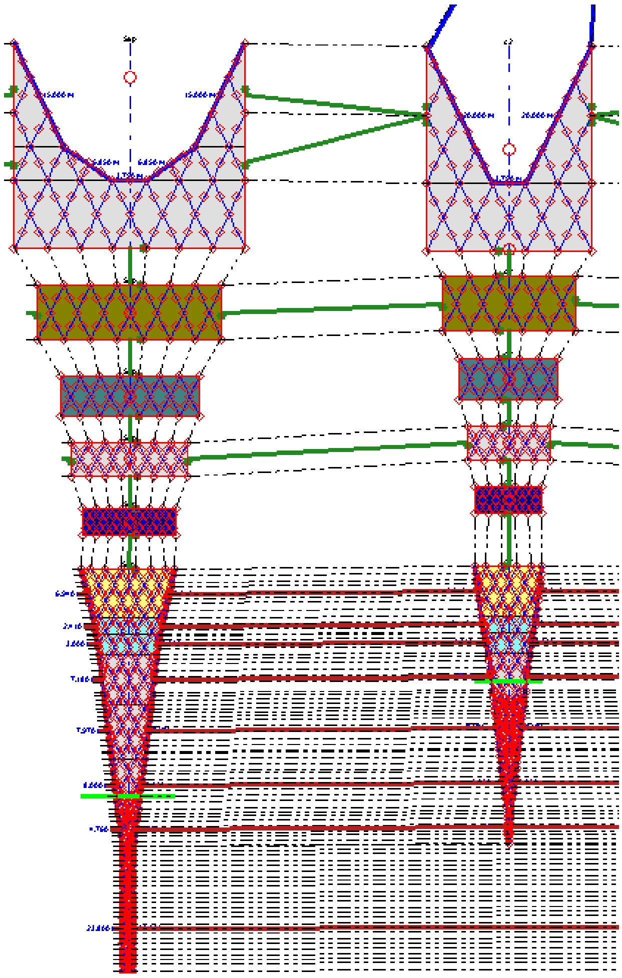


Fig. 4
You cannot define a single panel for each set of 6 netting sections because the virtual mesh is not continuous (mesh sides are different for each netting section)

The figure 4 is the typical case of use of real mesh instead of virtual mesh. For this midwater trawl, the mouth meshes are large enough (16 m mesh side) to be represented by numerical meshes that have the same size. No virtual mesh is used in this case.

Consequently, for this midwater trawl, the different big meshes netting sections cannot be joined together. If they where, DynamiT could not respect the different real mesh sizes.

Numbers

Some numbers in DynamiT are written using the "scientific format" : material stiffness, convergence or accuracy indicators …

```
Ite    50 Date    0.05  R1=2.17e-003 (bar  432(  394-  358) tens=-3.10e+003)  R0=4.88e-003  in    5 ite. CVx=9.92e-001
Ite   100 Date    0.10  R1=1.16e-003 (bar  534(   55-  399) tens=-3.98e+005)  R0=2.67e-003  in    6 ite. CVx=9.87e-001
Ite   150 Date    0.15  R1=9.55e-004 (bar  513(  467-  389) tens=1.51e+005)  R0=9.48e-004  in    5 ite. CVx=9.81e-001
Ite   200 Date    0.20  R1=3.94e-004 (bar  535(  399-  400) tens=-3.03e+005)  R0=1.20e-003  in    3 ite. CVx=9.80e-001
Ite   250 Date    0.25  R1=2.57e-004 (bar  600(  400-  468) tens=1.42e+005)  R0=1.38e-003  in    3 ite. CVx=9.89e-001
Ite   300 Date    0.30  R1=4.08e-004 (bar  334(  259-   55) tens=-1.41e+005)  R0=1.19e-003  in    3 ite. CVx=1.00e+000
Ite   350 Date    0.35  R1=2.34e-004 (bar   32(   32-   33) tens=3.88e+004)  R0=5.49e-004  in    3 ite. CVx=1.02e+000
```

For instance :

R1 = 3.20e-003 means
R1 = 3.20 x 10^{-3} or
R1 = 3.20 x 0.001
R1 = 0.0032

CVx=1.02e+000 means
CVx=1.02

Some DynamiT conventions regarding netting sections definitions

Cuttings :

- when a cutting goes up right, it is written AB (tp) for instance.
- When a cutting goes up left, it is written –AB (-tp) for instance.

The values of D (D1 and D2) are :

- positives when going right of the panel axis,
- negative when going left of the panel axis.

Example :