Sofia Remote User Manual

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I Overview

SofiaRemote is a Software As A Services (SAAS) provided by GSeaDesign that offers an easy and secure way to compute foil deformed shape and stresses under a sailing navigation loading at the equilibrium, using Fluid Structure Interaction process.

From an initial shape along with material/laminating data and loading inputs, *SofiaRemote* computes the 3D deformed shape of the foil at the equilibrium.

- The fluid calculation model used is the AVL vortex lattice method with 2D hydrodynamic coefficients generated by XFoil.
- The structural calculation model is a composite Timoshenko finite elements beam model.

This document describes the entire *SofiaRemote* computation process, which successively consists in:

1. First setup *SofiaRemote* computation input:
   - Either by using the *SofiaRemote* preprocessor (Microsoft Excel spreadsheet) to design a custom foil and generate a **.XML** input file;
   - Or by writing a **.INI** input file to use custom computation settings on an existing foil available in *SofiaRemote* foils library;
2. Then run *SofiaRemote* computation agent to easily and securely request computation on input file;
3. Finally, collect and analyze computation output available in a **.ZIP** archive which contains:
   - Foil geometries (in **.IGS** format) ;
   - Computation results (in text files).

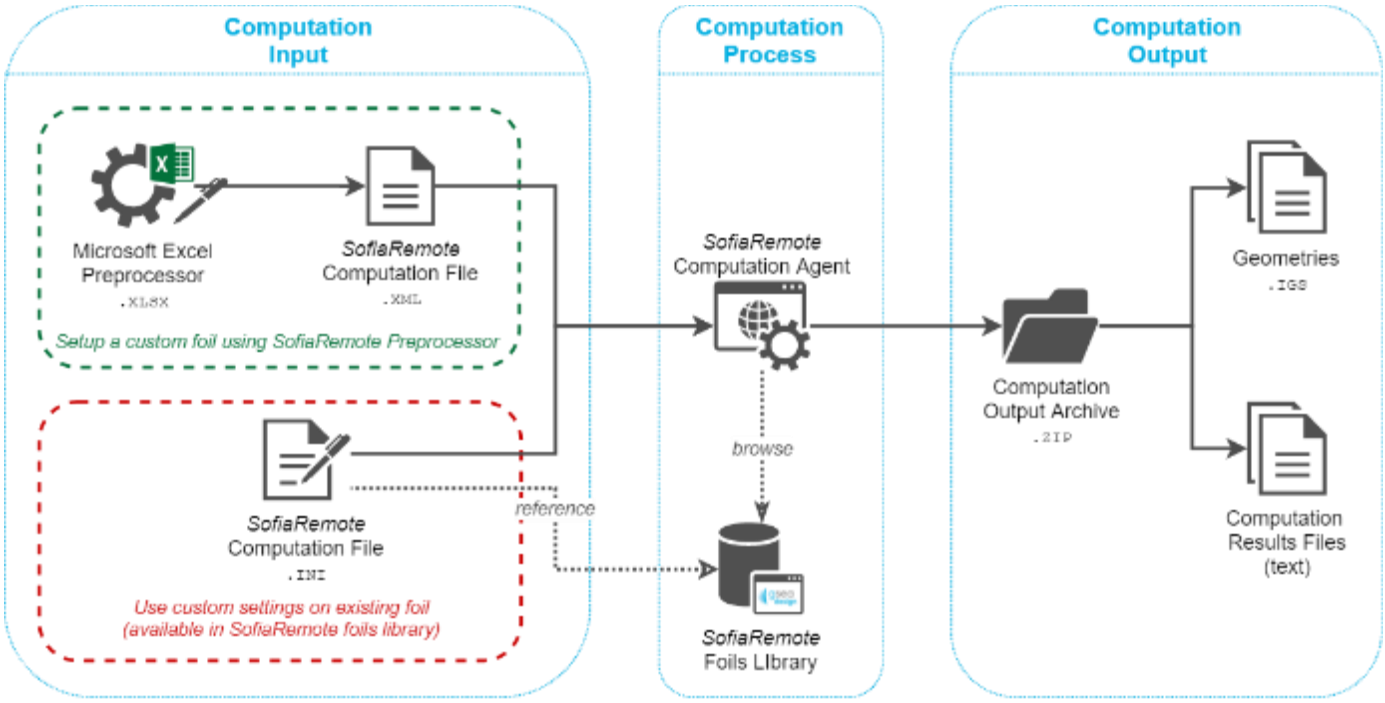


Figure 1. Computation Process Overview

II - XML Computation Input – Design A Custom Foil Using Preprocessor

SofiaRemote preprocessor is a Microsoft Excel spreadsheet which aims at design a new foil (geometry, material) and define computation settings (speed, angles, load); in the end, it generates a `.XML` file that can be processed by *SofiaRemote* computation agent.

The *SofiaRemote* preprocessor is available in the *Downloads* section of Manage Subscription page (refer to account creation and subscriptions management information for more details) and allows designing a custom foil by following these steps:

1. Set the different sections contours in XFoil `.DAT` format (*General* tab);
2. Position the sections at nodes locations to define the foil main shape/geometry (*Geometry* tab);
3. Describe the mechanical properties and the inner geometry of sections (*MAT*/*GEO* tabs);
4. Parametrize the foil for computation (*Settings* tab).

A full sample project called `SofiaRemote-Sample-FoilDesign.zip` is also available for download (at same location), which contains:

- A sample XFoil `.DAT` file (NACA section profile/contour);
- An example of preprocessor filled with a foil geometry and 4 different types of geo/material;
- Pictures and 3D files (in IGES format) of the corresponding foil shape and sections.

The followings detail how to properly fill the different worksheets/tabs available in *SofiaRemote* preprocessor, and finally create a `.XML` file that can be run for computation.

II.1 General Tab – Overall Design Process

The *General* tab summarizes all the design follow and provides control buttons for mains action required:

1. First, you need to load the different sections profiles/contours (in XFoil `.DAT` format) by clicking the *Load Sections contour data* button on *General* tab (see more details about sections contours loads);

2. Then fill the *Geometry* tab to describe the foil main shape by positioning nodes, associating them a section profile/contour (previously loaded from `.DAT` files) and assigning them to a material group (see more details about main geometry description);

3. Back to the *General* tab, click the *Generate MAT sheets* button to create a *MAT* tab and a *GEO* tab for each group deduced from *Geometry* tab setting (WARNING : data previously set in MAT and GEO tabs will be lost);

4. Then fill all the *MAT* tabs (one per material group declared) to set the sections mechanical properties (see more details about sections mechanical properties);

5. Back to the *General* tab, click the *Update GEO sheets* button to update all the *GEO* tabs according to the settings previously set their related *MAT* tab;

6. Then fill all the *GEO* tabs (one per material group declared) to adjust the inner sections geometric properties (see more details about inner sections geometric properties);

7. Go to the *Settings* tab to set the computation parameters to use for computation (see more details about computation settings);

8. Finally back to the *General* tab, click the *Create your Sofia input file* button to generate the XML file corresponding to your foil: now you are ready to process it to *SofiaRemote* computation agent.

Figure 2: General Tab Overview

II.2 General Tab – Sections Contours .DAT Load

Sections contours are described in XFoil format and imported in *SofiaRemote* preprocessor through `.DAT` files. Their can easily be produced using desktop application JavaFoil or online tool AirFoil for instance.

Figure 3: NACA2412 section contour produced with AirFoil

Indeed `.DAT` file is a plain text file that can be edited with any text editor (such as Windows Notepad, Notepad++ or Visual Studio Code). Its syntax is very simple and must fulfill the following requirements:

- First line is a comment describing the section (always skipped in the followings);
- Each next line is the X and Y coordinates of a point contour (separated by space(s)).

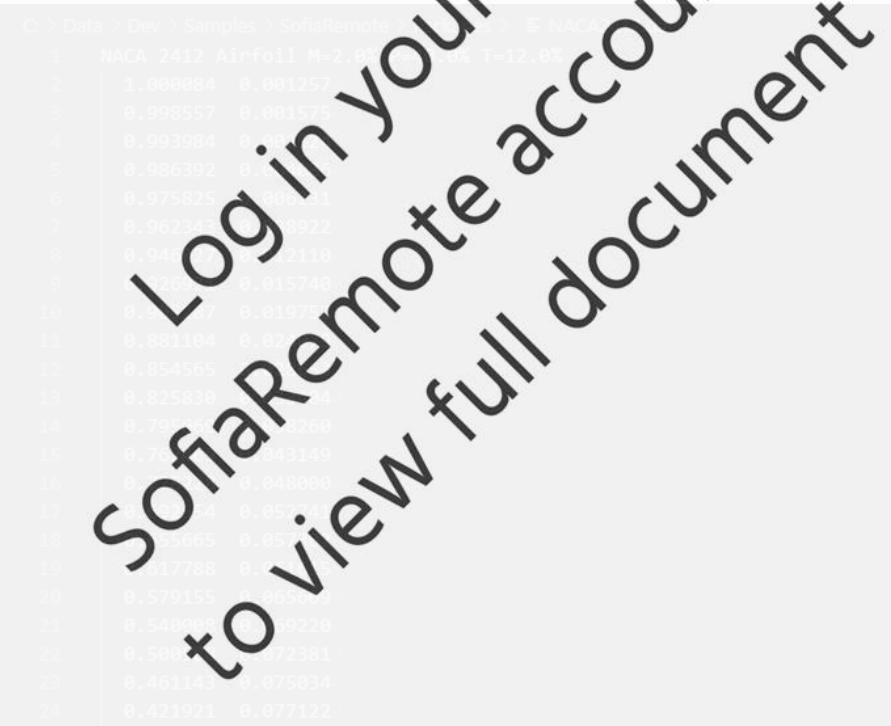


Figure 4: Contents of NACA2412.DAT file

To load your XFoil `.DAT` files, click on the *Load Sections contour data* button in the *General* tab:

- If any sections contours were previously loaded, a message box pops up to ask if you want to clear these previous sections. If you click *Yes*, all the sections previously loaded are removed and can not be selected in the *Geometry* tab;
- An open dialog pops up, allowing you to browse a folder and select a `.DAT` file to load. Notice that you can select multiple files in folder at the same time by holding the CTRL button when clicking on files. When clicking the *OK* button, files are then imported, and a message box pops up in the end to summarize the files loaded.

Notice that you need to import only sections contours with different shapes (not with different size/ratio). Indeed, when affecting sections on main shape (in the *Geometry* tab), you will have set the length and height of the section (*Chord* and *Relative Thickness* fields): the section contour will be adapted according to these settings when running *SofiaRemote* computation.

II.3 Geometry Tab – Foil Shape/Geometry

The *Geometry* tab aims at modeling the foil shape and geometry by scaling and positioning sections in 3D-space. Each section is placed at a location called *Reference Node*. The more reference nodes the foil model contains, the more accurate the foil model is. The foil model can also contain intermediate nodes (called *Interpolated Nodes*) whose properties are interpolated from nearest reference nodes.

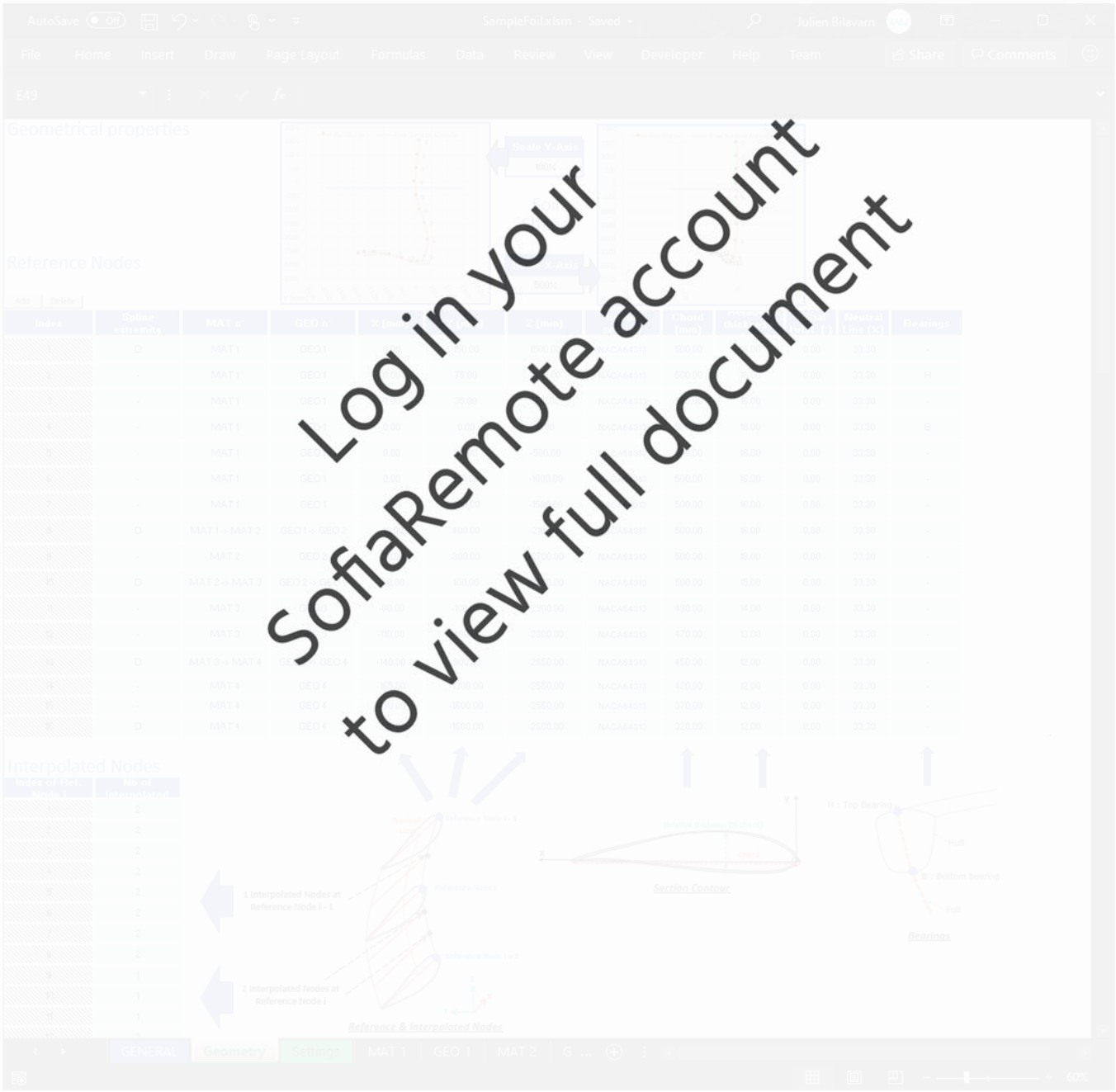


Figure 5: Geometry Tab Overview

II.3.1 Reference Nodes

Reference nodes properties can be edited in the *Reference Node* table. Use the *Add* and *Delete* buttons to add/remove a node in table last position (it properly adds or remove last row in table).

A reference node requires the following information:

Parameter	Description
Index	Node identifier (automatically set, cannot be edited)
Spline Extremity	Flag indicating if a new material group is starting at current node (using "D" flag). Make sure both first and last nodes are set to "D" flag. Refer to Material Groups description for more details.
MAT # GEO #	Name of MAT and GEO sheets corresponding to the material group the node belongs to (automatically set when clicking the *Generate MAT sheets* button in *General* tab, cannot be edited)
X Y Z	Node X/Y/Z positions in the boat classical coordinates system (in millimeters). Corresponds to the position of the section (on leading edge).
Shape Section	Section contour position Select a section contour shape from *.DAT file loaded in *General* tab.
Chord Relative Thickness	Width of the section (in millimeters) Thickness (in % of the chord) of the section at this node.
Initial Twist	Initial twist/rotation of section (around Z-axis of section coordinates system)
Neutral Line	Position of neutral line along chord, relative to leading edge node (in % of chord)
Bearings	Flag indicating if the node is located at foil upper bearing ("H" flag) or lower bearing ("B" flag). Needed to simulate the behavior of the hull on the foil. Make sure you always have exactly these two bearing nodes defined in this table in the right order.

II.3.2 Interpolated Nodes

Intermediate nodes can be inserted between reference nodes. The properties of these nodes are automatically interpolated from the nearest reference nodes:

- Geometric properties (nodes position, chord, thickness, neutral line…) are interpolated according to the leading and trailing edges curves;
- Mechanical properties computed by *SofiaRemote* at runtime are interpolated linearly.

II.3.3 Material Groups

In the Reference Nodes table, using *D* flags in the *Spline extremity* field, it is possible to split the foil in different material groups. The following example shows a foil defined in 4 material groups:

Index	Spline extremity	MAT n°	GEO n°
1	D	MAT 1	GEO 1
2	-	MAT 1	GEO 1
3	-	MAT 1	GEO 1
4	-	MAT 1	GEO 1
5	-	MAT 1	GEO 1
6	-	MAT 1	GEO 1
7	-	MAT 1	GEO 1
8	D	MAT 1 -> MAT 2	GEO 1 -> GEO 2
9	-	MAT 2	GEO 2
10	D	MAT 2 -> MAT 3	GEO 2 -> GEO 3
11	-	MAT 3	GEO 3
12	-	MAT 3	GEO 3
13	D	MAT 3 -> MAT 4	GEO 3 -> GEO 4
14	-	MAT 4	GEO 4
15	-	MAT 4	GEO 4
16	D	MAT 4	GEO 4

Figure 6 Example of groups definition

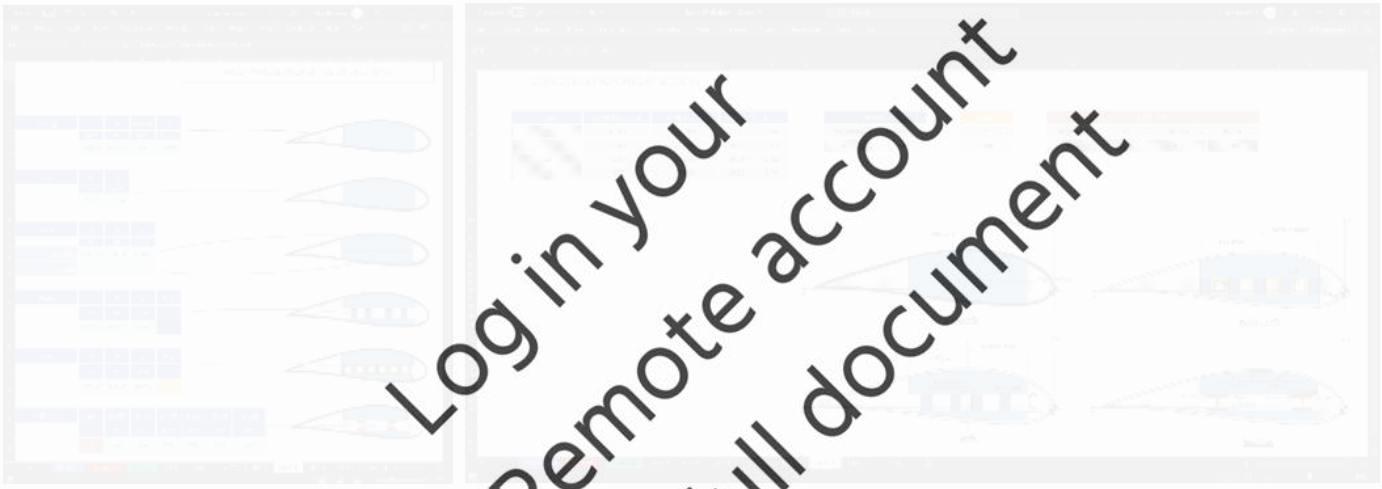
A group is a set of nodes/sections sharing the same internal structure and same mechanical properties: sections full of stock, with webs, with webs and cells, with half-cells …

Two sheets called *MAT#* and *GEO#* are created to allow configuring each group. When updating the reference nodes that belongs to a group (e.g. when changing the "D" flag of a reference node), do not forget to click again on the *Generate MAT sheets* button in the *General* tab : this will create as many MAT/GEO sheets as needed (WARNING : parameters previously set in MAT and GEO will be lost) and update the *MAT #* and *GEO #* fields in the *Reference Nodes* table in the *Geometry* tab.

II.4 MAT & GEO Tabs – Groups/Sections Mechanical And Geometric Props

Two sheets/tab are available for each material group defined through the *Geometry* tab:

- The *Mat #* tab, that allows specifying the mechanicals properties common to all sections in the group;
- The *Geo #* tab, that allows describing in detail the inner geometry of each section of the group.



MAT Application Overview

Standard process usually consists in:

1. First filling all the *MAT* tabs to set for all groups the kind of sections used and the mechanical values of the different materials (density, Young and shear modulus);
2. Then clicking the *Update GEO sheets* button in the *General* tab to update all the *GEO* sheets (for all groups);
3. And finally filling all the GEO tabs to set the geometric values specific to all sections in groups (size of inner/outer stock, position and size of webs / cells / half-cells if any);

If you need to modify settings in a *MAT* tab, do not forget to click again on the *Update GEO sheets* button in the *General* tab. Notice that all the settings previously set in the *GEO* tabs will be preserved if still relevant (for instance, webs settings will not be preserved if group is not using anymore webs).

II.4.1 MAT – Sections Types And Mechanical Properties

In a *MAT* tab, you can describe for all the sections in the corresponding group the materials to use (located in different areas of the section) as long as the corresponding mechanical values : Young Modulus E, Shear Modulus G and Density ρ (in kg/m^3). Settings are divided in different tables: Fairing, Core, Stock, Webs, Cells and Half-Cells.

Figure 8 Settings available in MAT tab

For now, the following types of section can be described and the following parameters to be filled:

	Stock only Possibly different materials for extrados and intrados (leave *Intrados* settings to use same settings as *extrados*)	☑ Fairing ☑ Core ☑ Stock
	Webs Require the count of webs *Qty* as well as webs material properties (*E, G, ρ*)	☑ Fairing ☑ Core ☑ Stock ☑ Webs
	Webs + Cells Require the count of webs *Qty* as well as both webs and cells material properties (*E, G, ρ*). Count of cells *Qty* is deduced from webs count	☑ Fairing ☑ Core ☑ Stock ☑ Webs ☑ Cells
	Half Cells Require the count of half-cells as well as materials properties (*E, G, ρ*) for exterior (edges along extrados and intrados stocks) and interior (main inner structure)	☑ Fairing ☑ Core ☑ Stock ☑ Half-Cells

WARNING: Always leave/reset values of unused tables to 0, never use empty values (except for stock intrados).

After modifying settings in a MAT tab that may changes the type of sections used for a group, you must click the Update GEO sheets button in the General tab to enable/disable proper settings in the corresponding GEO tab.

II.4.2 GEO – Sections Geometric Properties

In a *GEO* tab, you can adjust the position and size of the different group materials (stock, webs, cells, half-cells) according to the corresponding *MAT* tab settings.

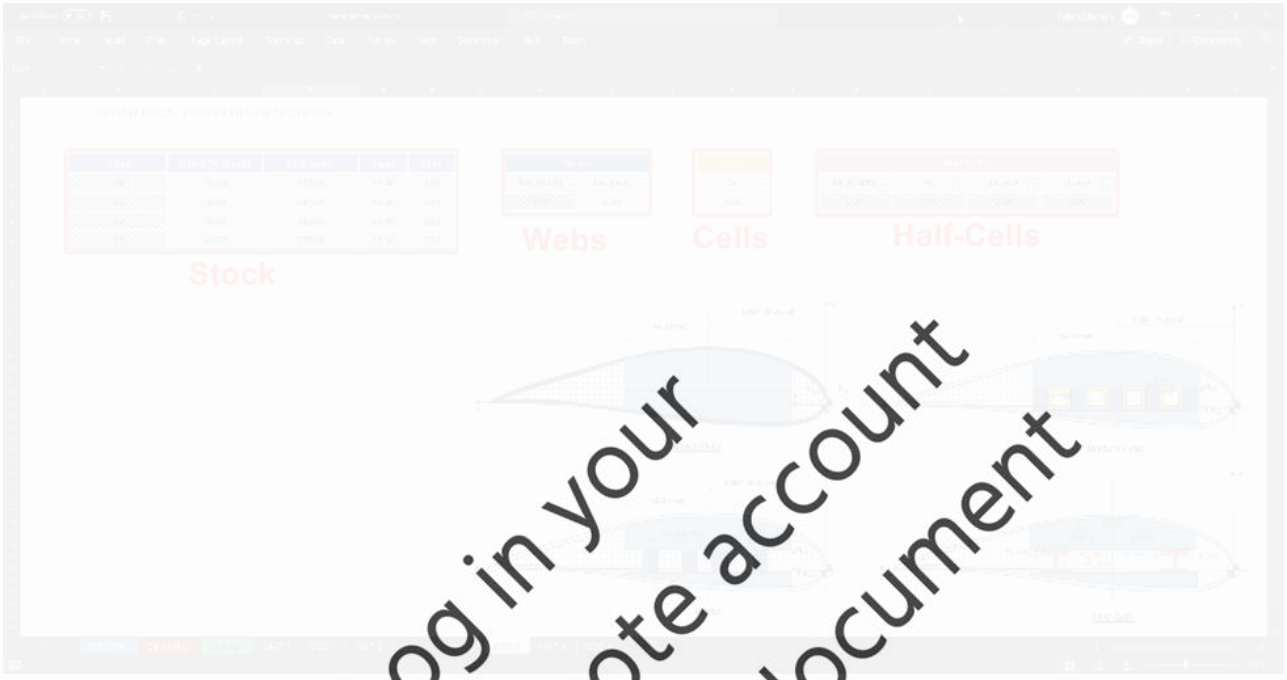


Figure 9 Sections Available in GEO Tab

For each section in the group, you must specify the stock position UDMT (in % of chord) and length bUd (in mm), as well as the positions of stock extrados and intrados edges from chord line (Hext and Hint, in mm). Other parameters are be required according to the group's sections type:

Stock Only

If same materials for both extrados and intrados: leave Hext and Hint to 0

Otherwise (if different materials for extrados and intrados): set Hext = - Hint

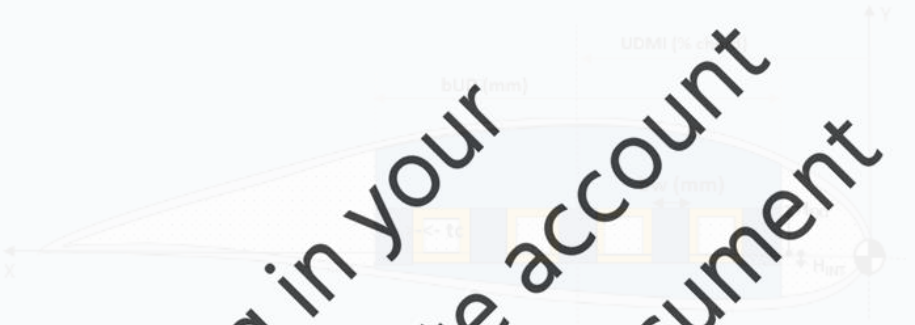
Webs

For each web, require its size `bw` (in mm) and position `Xw` (in % of stock length, starting from stock center, positive value on tail / negative value on nose).

Height is deduced from `Hext - Hint` value (so ensure that `Hext > Hint` for each section).

Ensure that webs are declared in table in ascending order of `Xw` values (from -50% to +50%).

Webs + Cells



Require webs size `bw` (in mm) and [illegible] of stock length, common to all sections, webs/cells are equally arranged along the anti[illegible]k length.

Height is deduced from `Hext - Hint` [illegible] `Hext > Hint` for each section).

Half Cells

For each half-cell, require its base length `Lh` (in mm), outer thickness `th.ext` (in mm), inner thickness `th.mid` (in mm) and position `Xh` (in % of stock length, starting from stock center, positive value on tail / negative value on nose).

Height is deduced from `Hext - Hint` value (so ensure that `Hext > Hint` for each section).

Ensure that half-cells are declared in table in ascending order of `Xh` values (from -50% to +50%).

II.5 Settings Tab – Computation Parameters

The *Settings* tab aims at configuring the computation that will be run on the foil previously designed. Let's first introduce the computation principles before describing in detail the computation settings.

II.5.1 Computation Principles

In *SofiaRemote*, the positioning angles of the foil are defined in the global coordinate system. If we consider a multihull boat with a classical foil, the boat is considered on the starboard tack, so the port appendage is modelled.

The appendage is the only part modelled in *Sofia*. In the software, the boat is considered totally flat, the following angle hypothesis are thus used:

Plane	Reference	Angle
XY	Yaw + Toe	Yaw
XZ	Rake + Pitch	Rake
YZ	Cant + Heel	Cant

Table 1 Angle definition

The Reference Nodes that are defined in pr[illegible] define the shape of the foil for a given Cant angle. However, Yaw and Rake angles are considered equal to 0 in the initial geometry.

Yaw and Rake angles are only used for the [illegible] computation. These angles can be optimized using the *Load* computation.

Yaw and Rake angles represe[illegible] angle of t[illegible] the hull, same thing for the cant angle that represents the angle between the bearings and the global coordinate system Z axis.

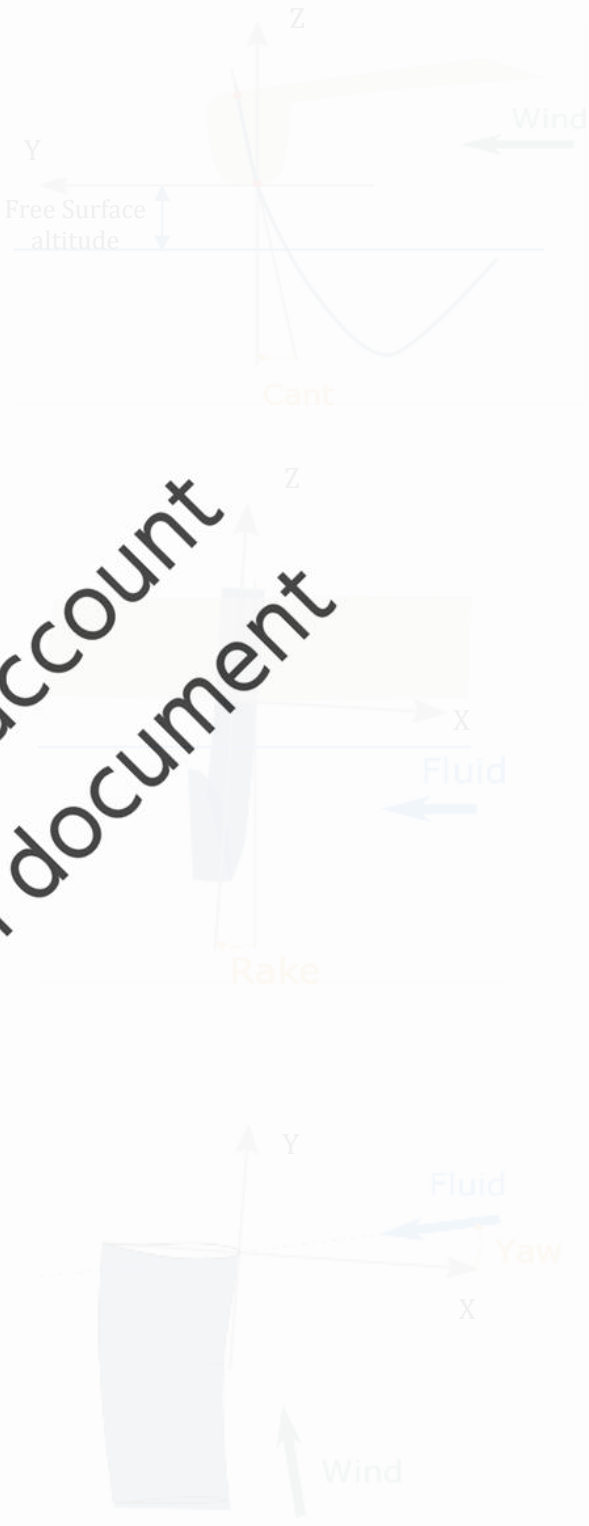


Figure 10. Sofia coordinates definition

II.5.2 Computation Settings

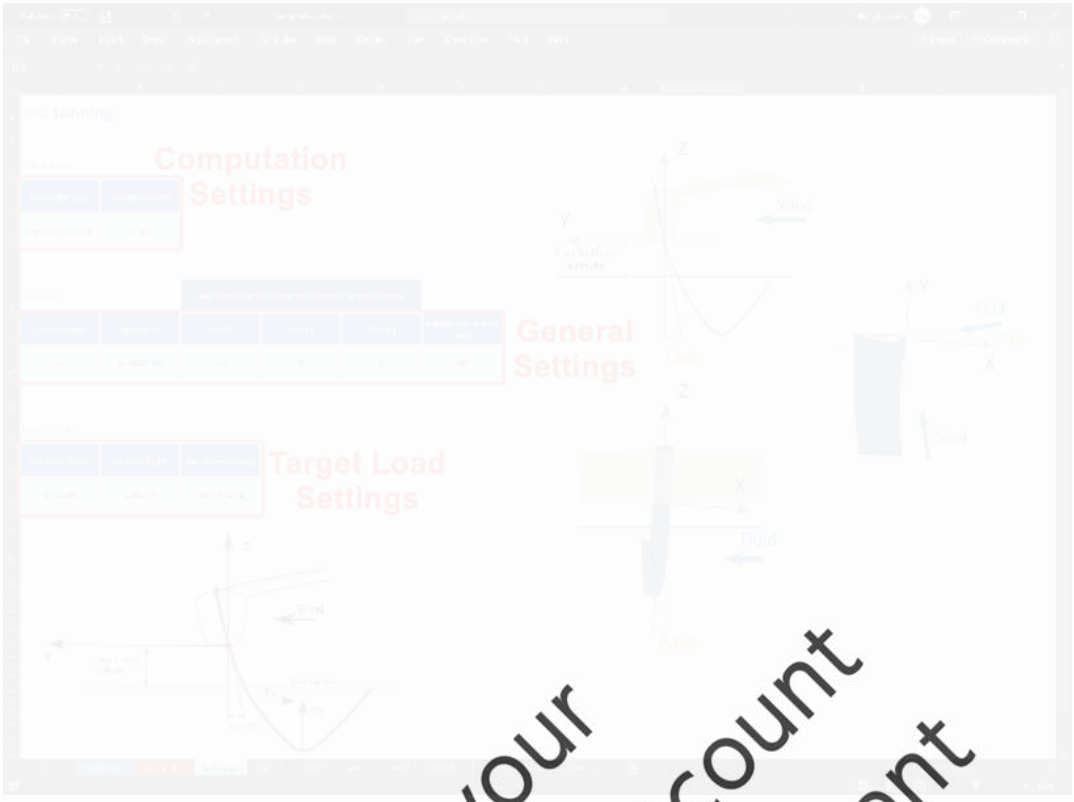


Figure 11 : Settings Tab Overview

The following settings must be defined to properly setup foil computation:

Calculation Settings	
`Calculation Type`	Choose between: • Angle Calculation: Simply compute foil deformation according to speed, angles and altitude set in *General Settings* table; • Target Load Calculation: Runs several computations to reach the loads set in *Target Load Settings* table by adjusting angles and/or altitude, and finally computes the corresponding foil deformation.
`Calculation Mode`	Choose between: • Simple: Run a single iteration per computation (faster); • Full: Run several iterations per computation, as a linear fluid-structure interaction computation (accurate).
General Settings	
`Speed`	Boat speed (in knots). Speed in m/s is automatically deduced from this.
`Cant, Yaw, Rake`	Foil orientation angles (in degrees). Refer to computation principles for more details.
`Free Surface Altitude`	Boat altitude (in mm), relative to lower bearing reference node. Refer to computation principles for more details.
Target Load Settings (for Target Load Calculation only)	
`Up Force, Side Force`	Up and side forces to reach (in N).
`Parameters To Vary`	Set of parameters to vary in order to reach the target loads. Must a combination of 2 parameters among `Yaw`, `Rake` and `Altitude`.

Each time you edit the computation settings through the *Settings* tab, you need to go back to the *General* tab and click the *Create your Sofia input file* button: the `.XML` file generated is then ready to be run for computation using SofiaRemoteClient.

III INI Computation Input - Compute Existing Foil Using Custom Settings

If you do not want to design a new foil on your own, *SofiaRemote* can also be used to run computation with custom settings on an existing foil available in *SofiaRemote* foils library. To do so:

- First contact GSeaDesign to be granted access to a foil in library : you will be issued a foil project identifier that will allow you to run computations with your own settings on that foil;
- Get the `.INI` template file available in the *Downloads* section of Manage Subscription page (refer to account creation and subscriptions management information for more details);
- Rename `.INI` file with a suitable label (ensure to keep the `.INI` extension);
- Edit `.INI` file with any text editor (such as Windows Notepad, Notepad++ or Visual Studio Code) as described in the followings to set your own computation parameters;
- Save `.INI` file, which is now ready to be run for computation using SofiaRemoteClient.

The followings describe how edit your `.INI` with custom computation settings.

III.1.1 File Syntax

The `.INI` file is a list of entries `Parameter=Value` organised in sections declared with brackets. For instance, any entry set after the `[General]` label (but before the `[Computation:01]` label) belongs to the *General* section.

```
C: › Data › Dev › Samples › SofiaRemote › [illegible]
################################################################################

[General]

################################################################################

# ID of the [illegible] to compute
ProjectID=0[illegible]0000-0000-0000-000[illegible]



################################################################################

[Computation:01]

################################################################################

# Computation type : select between 'Angle Calculation' and 'Target Load Calculation'
Type=Angle Calculation
#Type=Target Load Calculation

# Speed (knots)
Speed=30

# Free surface altitude (mm)
Altitude=-200

# Bearings Offset (mm)
BearingsOffset=200

# Orientation angles (degrees)
AngleCant=-45
AngleYaw=-5.5
AngleRake=2.5

# Target load (N)
TargetUpForceFz=15000
TargetSideForceFy=25000

# Parameters to vary for target load calculation : select between 'Yaw + Rake', 'Yaw + Altitude' and 'Rake + Altitude'
TargetParametersToVary=Yaw + Rake
```

Notice that any line starting with the # character is considered as a comment and ignored.

III.1.2 General Settings

The `[General]` section contains generic parameters about the foil to use:

Parameter	Description
`ProjectID`	Identifier of the existing foil to retrieve in *SofiaRemote* foils library Contact GSeaDesign to obtain ID and access to a specific foil in library

III.1.3 Computation Settings

The `[Computation:01]` section contains the specific computation parameters (same settings that can be setup in the Preprocessor *Settings* tab). Refer to Preprocessor Settings tab for more details:

Parameter	Description
`Type`	Type of computation to run Select between `Angle Computation` and `Target Load Computation`
`Mode`	Iteration mode of computation to run Select between `Simple` and `Linear`
`Speed`	Boat speed (in knots)
`Altitude`	Free surface altitude (in m)

`AngleCant`
`AngleYaw`
`AngleRake`
	Foil orientation (in degrees)

`TargetUpForceFz` `TargetUpForceFy`	For target load computation, target up and side forces (N) to reach
`TargetParametersToVary`	For target load computation, parameters to vary to reach target load Select between `Yaw + Rake`, `Yaw + Altitude` and `Rake + Altitude`

IV Computation Run

SofiaRemote computations are processed using the *SofiaRemoteClient* multi-platform application (Windows, MacOS, Linux). It processes a computation input file (either `.XML` file generated by *SofiaRemote* preprocessor or `.INI` edited manually from template) to GSeaDesign computation servers and collect computation results. To be run, it requires a valid subscription that can be purchased through *SofiaRemote* online account.

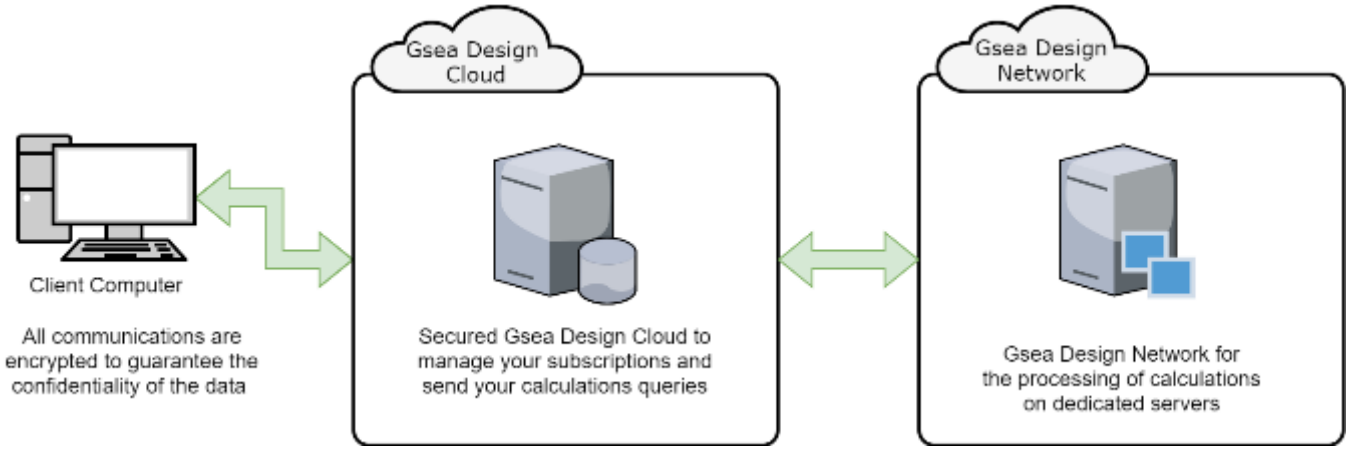


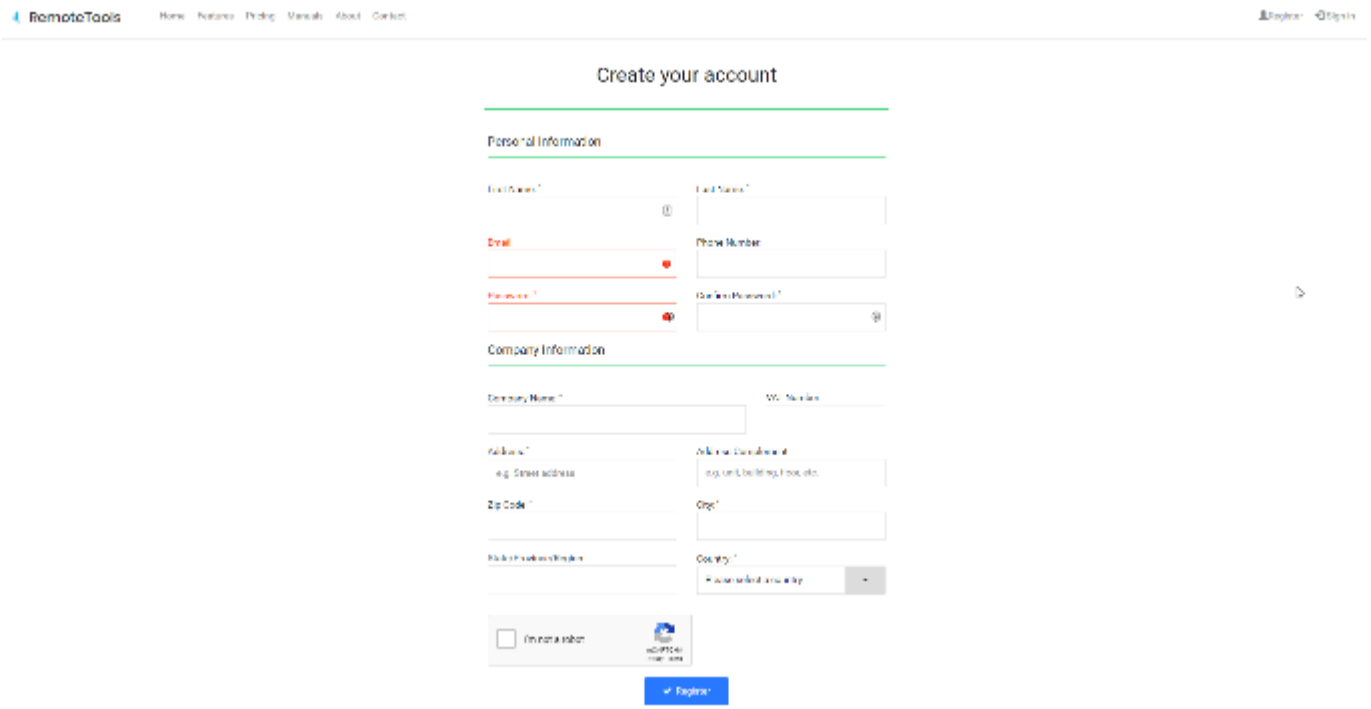
Figure 12. Remote Computation Workflow

IV.1 Subscription & User Token

A valid subscription is needed to request SofiaRemote computations and can be purchased using a user account on SofiaRemote website.

IV.1.1 Account Creation

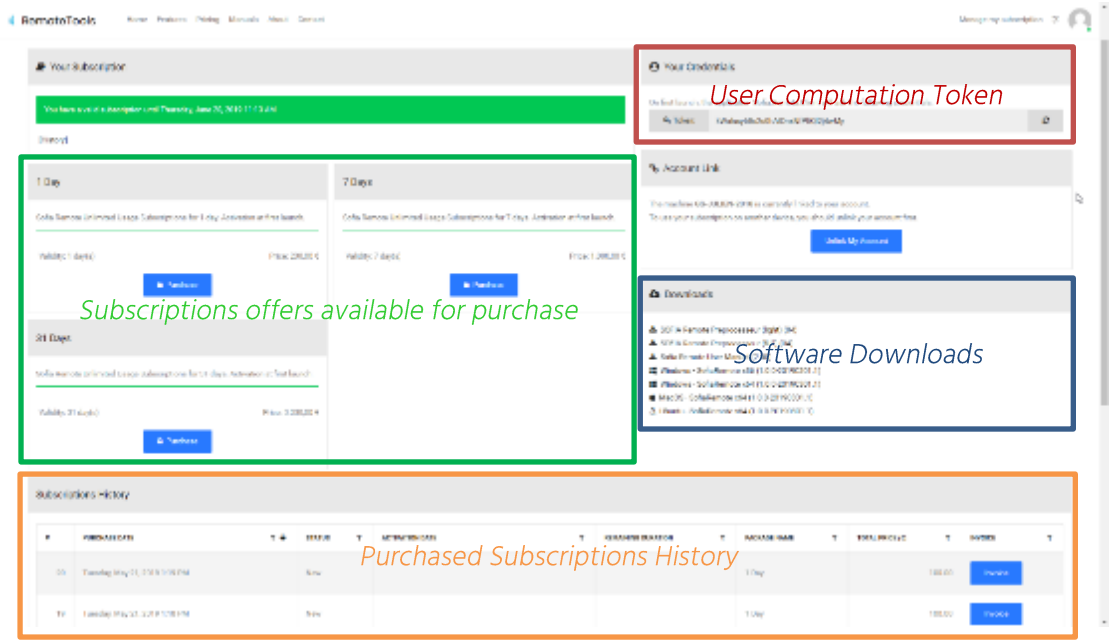
Go to registration page and fill form:



A confirmation e-mail is automatically sent to submitted address and contains a link to confirm account creation.

IV.1.2 Subscriptions Management

Registered users can purchase subscriptions in Manage Subscription page (green frame below). All purchased subscriptions are listed in subscriptions history (orange frame below), including activated and expired subscriptions. Notice that purchased subscriptions are activated only when they are used to request a computation for the first time.



Each user is granted a unique User Computation Token (red frame above) linked to its account, which is used by computation server to check that a valid subscription is available for a user.

IV.2 SofiaRemoteClient Installation

The *SofiaRemote* client is a portable console application that does not require any third-party dependency. It runs under the following systems:

- Windows 7 SP1 and higher (both 32 and 64 bits);
- MacOS X 10.12 and higher (64 bits);
- Linux Ubuntu 14.04 and Fedora 17 (64 bits).

Download from *Downloads* section in Manage Subscription page (blue frame above) the *SofiaRemoteClient* archive corresponding to current system, and extract it in a folder, for instance `C:\GseaDesign\SofiaRemote`. Once done, ensure that the extract folder and all sub-folders have write access for any users allowed to run computations.

IV.3 SofiaRemoteClient Usage

The *SofiaRemoteClient* application can be run through a command-line prompt (see how to open a command-prompt in Windows for instance) or a batch script (see Windows batch examples).

IV.3.1 Computation Request

The *SofiaRemoteClient* application can be run using the following command:

```
WINDOWS:    C:\GseaDesign\SofiaRemote\sofiaremote.cmd "<INPUT-FILE-TO-PROCESS>"
LINUX / MAC: C:\GseaDesign\SofiaRemote\sofiaremote.sh "<INPUT-FILE-TO-PROCESS>"
```

For instance, the following command requests a computation on file `D:\Data\foil.xml` on a Windows system:

```
C:\GseaDesign\SofiaRemote\sofiaremote.cmd "D:\Data\foil.xml"
```

IV.3.2 Anonymous Data Collection

When run for the first time, the *SofiaRemoteClient* application prompts user to allow anonymous data collection:

```
Telemetry [ WARN ] Sofia Remote peut collecter des données dans le but d'améliorer votre
expérience du logiciel (erreurs, utilisation...). Acceptez-vous d'envoyer ces données
anonymes à GSea Design?
[Oui/Non] :
```

This anonymous and secure data collection is needed for solving application errors and improving user experience from usage feedback.

IV.3.3 Subscription Validation

On each run, the *SofiaRemoteClient* application checks if current user is allowed to use the service by requesting the authentication key (user token) available in the *Credentials* section of the *Manage Subscription page*:

```
Credentials [ WARN ] Vous devez vous identifier pour accéder à ce service.
Credentials [ WARN ] Veuillez vous identifier comme indiqué sur
https://remotetools.gseadesign.com/page
Clé:
```

This key is unique and can be used by only one user for one computation at the same time. This key is also locked to the computer when it was activated. However, it can be released using the *Account Link* section in *Manage Subscription page* to be used in another computer.

IV.3.4 Computation Processing

Once current user subscription is checked, the computation input file is processed, then results are received and saved on current user computer in the folder containing the computation input file.

```
Programm [ INFO ] Connexion à 'baptistin.gseadesign.com'
[...]
Programm [ INFO ] Connecté
Programm [ INFO ] Envoi de la demande de calcul pour 'D:\Data\foil.xml' avec les arguments
'foil.xml'
Programm [ INFO ] Demande de calcul envoyée
Programm [ INFO ] Calcul démarré
Programm [ INFO ] Réception du résultat de calcul
Programm [ INFO ]
```

If computation cannot be run immediately by computation servers, the *SofiaRemoteClient* application prompts a status indicating the position of current request in queue and the number of computation servers available (this information is refreshed every 15 seconds):

```
Program | INFO | Envoi de la demande de calcul pour 'D:\Data\foil.xml' avec les arguments
'foil.xml'...
[...]
Program | INFO | Demande de calcul envoyée.
Program | INFO | En attente de traitement en position 8 - (4 serveurs de calcul en ligne).
Program | INFO | En attente de traitement en position 5 - (4 serveurs de calcul en ligne).
Program | INFO | En attente de traitement en position 2 - (4 serveurs de calcul en ligne).
[...]
```

Sofia Remote finally upload computation input file on GSeaDesign remote server to perform the requested computation. Once done, the computation output files are stored in a `.ZIP` archive and downloaded near input file on local computer. In no case, computation input and output files are stored on the computation server or wherever. The process of file transfer and computation is unique, totally scripted and confidential.

IV.4 SofiaRemoteClient Troubleshooting

IV.4.1 Security

SofiaRemoteClient is a fully automated and secure application for computation processing. All communications between client computer and remote computation server uses TLS encryption and are never transmitted as plain text data.

IV.4.2 Error Messages

The directory « [..] » is not writable.	Make sure that current user can write in application folder and its sub-folders (write access).
Impossible de se connecter. L'erreur est : [...]	Check Internet connection. Contact GSeaDesign if problem persists.
Erreur d'authentification. Les erreurs sont: Invalid credentials.	Check authentication token.
Erreur d'authentification. Les erreurs sont: Account is deactivated.	User account is disabled. Contact GesaDesign.
Erreur d'authentification. Les erreurs sont: No valid subscription found.	No valid subscription for user account. Check *GseaDesign RemoteTools* website to purchase a subscription.
Erreur d'authentification. Les erreurs sont: License is used on another computer (XXX).	The authentication token was already used on another computer called *XXX*. Go to *GseaDesign RemoteTools* website to release the authentication token from this computer
Ce compte est déjà en cours d'utilisation sur cette machine. Pour lancer plusieurs calculs en parallèle, vous devez utiliser plusieurs comptes.	Another instance of the *SofiaRemote* application is running on current computer. A token allows running only one computation at the same time.
Erreur d'authentification. Erreur inconnue, Veuillez contacter le support de GSea Design	Unknown error. Contact GesaDesign for more information.

IV.4.3 Network Ports

The *SofiaRemote* application connects to computation servers through TCP ports 443 and 5671

IV.4.4 Log Files

Log files are used to diagnose any error encountered by the *SofiaRemote* application and should be requested when contacting GseaDesign support. These files called `Sofia.Remote.Client.#.log` are located in the `lib` sub-folder of the *SofiaRemote* application. So, for a *SofiaRemote* application located in `C:\GseaDesign\SofiaRemote`, log files are `C:\GseaDesign\SofiaRemote\lib\Sofia.Remote.Client.#.log`.

V. Computation Output

When *SofiaRemote* computation completed, the *SofiaRemoteClient* application collects a `.ZIP` archive whose contents depends on the computation input/process (either `.XML` or `.INI` input file). The files contained in this archive can be of 2 kinds:

- Geometry files in `.IGS` format (to be opened in 3D viewers);
- Computation data results in text format (to be opened in any text editor such as Windows Notepad, Notepad++ or Visual Studio Code).

V.1. Output Archive Contents

The output `.ZIP` archive contains the following files:

	XML Input	INI Input
Geometry Files		
➢ 3D initial/undeformed geometry (`.IGS` file)	✓	
➢ 3D final/deformed geometry (`.IGS` file)	✓	✓
➢ 2D sections geometry (`.IGS` file)		
Results Files		
➢ Final geometry nodes (`.GFI` file)	✓	
➢ Displacements per nodes (`.DFT` file)	✓	
➢ Hydrodynamic twists per nodes (`.TWT` file)	✓	
➢ Internal efforts per elements (`.EFT` file)	✓	
➢ Stress min/max per elements (`.ST` file)	✓	
➢ Summarized Final Efforts (`.EFT` file)		✓

V.2. Geometry Files

SofiaRemote exports geometries as `.IGS` files:

- 3D initial undeformed shape of the foil, that permit to check the geometry;
- 3D final deformed shape of the foil under the load case considered;
- Each section of the reference nodes defined in the preprocessor "*Geometry*" tab.

These files can be opened in any 3D modeler software, such as *Autodesk AutoCAD* or *Rhino*.

Figure 13: Visualization of a reference section

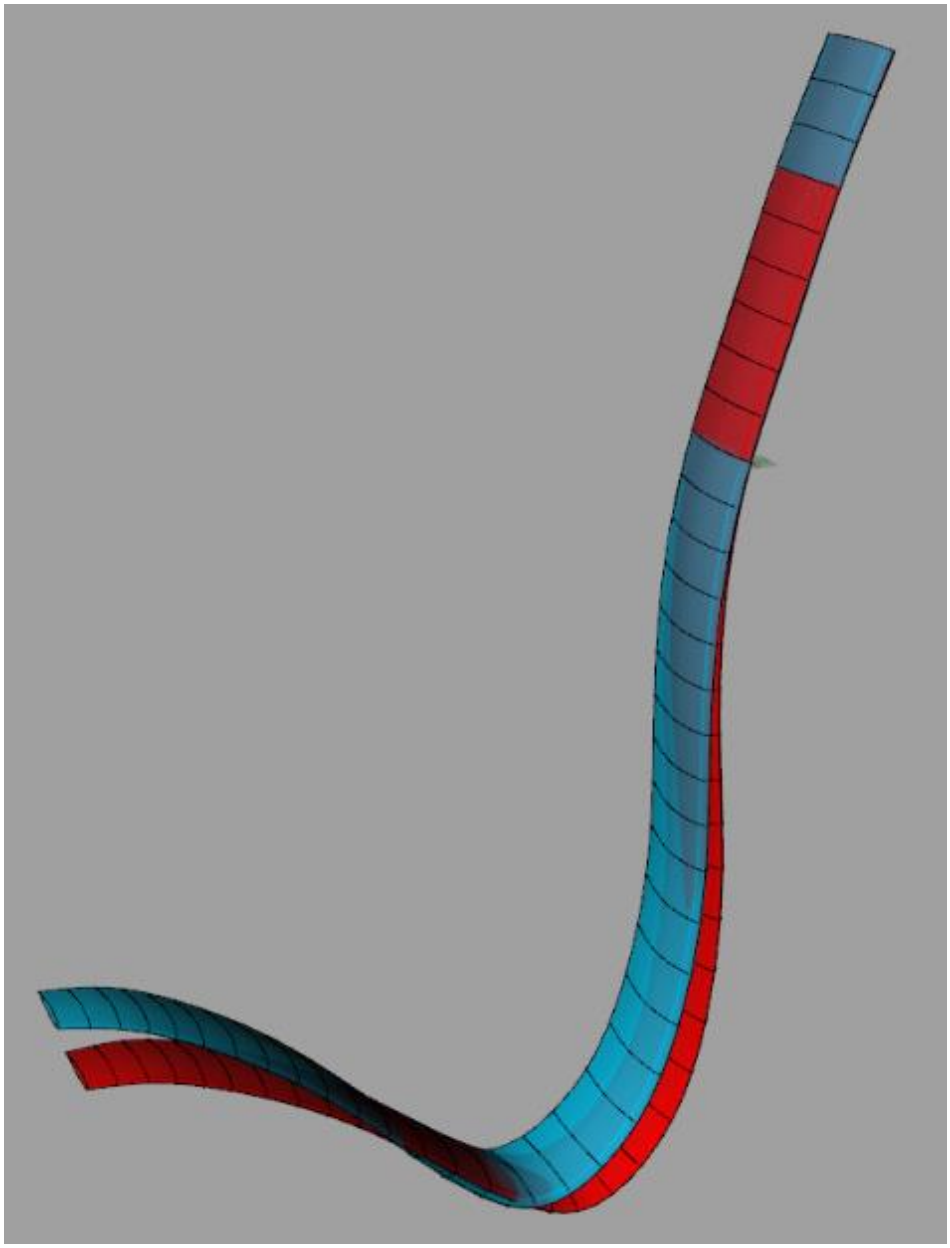
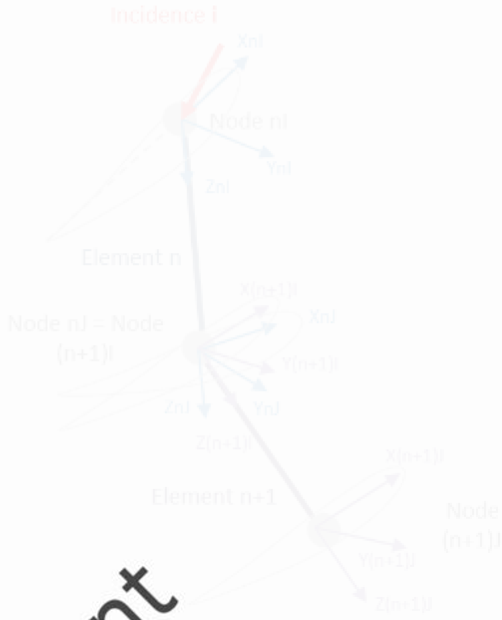


Figure 14. Visualization of both initial and deformed geometries

V.3 Result Files

V.3.1 Coordinates Convention



V.3.2 .GFI File – Final Geometry Nodes

```
FSA 3.39          E.F. 3D (Methode des Deplacements)
                  - Geometrie deformee finale -
 Fichier : ..\JobName-xx.GFI Date : xx-xx-xx  xxhxxmnxx
--------------------------------------------------------------------------------

                COORDONNEES et TYPES des NOEUDS

 xxx noeuds dans la structure

 Noeud       X          [illegible]                  Typ Maj  Corde   Epr   TwHydr
   1 -1.149188E+02  [illegible]      [illegible]      1    P   345.0  19.50  -0.00
   2 -1.146458E+02* [illegible]      [illegible]      1    P   345.0  19.50  -0.00
   3 -1.146314E+02  [illegible]      [illegible]      1    M   345.0  19.50  -0.00
   4 -1.146332E+02  [illegible]      [illegible]      1    M   345.0  19.50  -0.00
   5 -1.14666[illegible] [illegible] [illegible]      1    M   345.0  19.50  -0.00
   6 -1.147456[illegible] 2.832682E+[illegible] [illegible]284374E+02  1  M  345.0  19.50  -0.00
   7 -1.148850E+[illegible] 0.000000E+[illegible] 4.616000E-02  1  P  345.0  19.50  -0.00
   8 -1.150773E+02 -2.136657E+[illegible] -1.724677E+02  1  M   345.0  19.50   0.12
   9 -1.153112E+02 -4.64[illegible]E+01 -3.447626E+02  1    M   345.0  19.50   0.23
  10 -1.155861E+02 -[illegible]E+01 -5.168489E+02  1       P   345.0  19.50   0.35
  11 -1.158195E+02 -1.[illegible]90E+02 -7.109526E+02  1    M   345.0  18.77   0.50
  12 -1.160997E+02 -1.467411E+02 -9.050760E+02   1    M   345.0  18.19   0.64
  13 -1.164186E+02 -1.874297E+02 -1.099278E+03   1    M   345.0  17.75   0.86
  14 -1.167680E+02 -2.314584E+02 -1.293622E+03   1    P   345.0  17.45   1.05
```

The .GFI file provides all the information about the final geometry of the structure giving for each node the 3D coordinates, e.g. the nodes type, position and orientation (coordinates of the Y vector for each element of the foil).

V.3.3 .DFI File – Displacements Per Nodes

```
FSA 3.39          E.F. 3D (Methode des Deplacements)
  - Deplacements finaux - Calcul LIN.GEO. - Critere de converg.=  0.000E+00
 Fichier : C:\User...\xx.DFI                          Date : 15-02-18   15h16mn01s
-------------------------------------------------------------------------------

                xxx          DEPLACEMENTS AFFICHES

 Les valeurs suivies d une etoile indiquent un deplacement impose

 NOEUDS  X          Y          Z          Rot./X     Rot./Y     Rot./Z
         (mm)       (mm)       (mm)       (deg)      (deg)      (deg)

   1 -3.326E-02  -4.410E+00   4.883E-01   1.284E+00 -9.327E-03  3.195E-03
   2  0.000E+00 * 0.000E+00 * 0.000E+00 * 1.284E+00 -9.327E-03  3.195E-03
   3  6.222E-02   5.535E+00  -4.748E-01   1.109E+00 -7.314E-03  3.055E-03
   4  1.083E-01   9.681E+00  -8.281E-01   5.881E-01 -1.407E-03  2.646E-03
   5  1.230E-01   1.105E+01  -9.390E-01  -2.774E-01  8.225E-03  1.985E-03
   6  9.158E-02   8.281E+00  -6.874E-01  -1.485E+00  2.143E-02  1.081E-03
   7  0.000E+00 * 0.000E+00 * 4.616E-02  -3.033E+00  3.805E-02 -4.857E-05
   8 -1.423E-01  -1.125E+01   7.096E-01  -4.300E+00  4.469E-02 -1.233E-01
   9 -3.262E-01  -2.625E+01   1.592E+00  -5.509E+00  5.112E-02 -2.466E-01
  10 -5.511E-01  -4.481E+01   2.683E+00  -6.661E+00  5.734E-02 -3.699E-01
  11 -8.373E-01  -6.992E+01   3.856E+00  -7.958E+00  6.486E-02 -5.220E-01
  12 -1.160E+00  -9.956E+01   5.041E+00  -9.309E+00  7.171E-02 -6.939E-01
  13 -1.511E+00  -1.338E+02   6.179E+00  -1.068E+01  7.790E-02 -8.865E-01
  14 -1.883E+00  -1.727E+02   7.207E+00  -1.203E+01  8.314E-02 -1.115E+00
```

The .DFI file provides the final displacements and rotations at each node of the structure. It also contains the final global loads generated by the foil under the load case considered. For a correct load computation, the global loads computed must be close to the input values.

V.3.4 .HFI File – Hydrodynamic Twists Per Nodes

```
FSA 3.38          E.F. 3D (Methode des Deplacements)
  - Resultats - Twists Hydrodynamiques
 Fichier : C:\...\xx.DAT                          Date : ..h..mn..s
-------------------------------------------------------------------------------

  Nds.  TWIST HYDRO  TWIST HYDRO
        ABSOLU       RELATIF
        [°]          [°]

   1    8.262E-03    8.262E-03
   2    8.048E-03    8.048E-03
   3    8.130E-03    8.130E-03
   4    7.995E-03    7.995E-03
   5    7.6[illegible]  2.383E-03
   6    6.[illegible]  3.314E-03
   7    5.[illegible]  4.[illegible]E-03
   8    4.[illegible]  5.[illegible]E-03
   9    5.[illegible]E-02  [illegible]E-04
  10    9.423E-02    4.[illegible]E-03
  11    1.360E-01    4.011E-03
  12    1.734E-01    3.788E-03
  13    2.083E-01    3.316E-03
  14    2.386E-01    8.557E-03
```

The .HFI file provides the relative and absolute hydrodynamic twist for each node of the structure.

V.3.5 .RFI File – Internal Efforts Per Elements

```
FSA 3.39        E.F. 3D (Methode des Deplacements)
   - Efforts internes finaux - Calcul LIN.GEO. - Critere de converg.=  0.000E+00
 Fichier : ..\JobName-xx.RFI Date : xx-xx-xx   xxhxxmnxxs
--------------------------------------------------------------------------------

                          EFFORTS INTERNES

           EFFORT         MOMENTS                EFFORTS              MOMENT
           NORMAL       FLECHISSANTS            TRANCHANTS            TORSION
 ELTS NDS    Nz           Mx          My          Tx          Ty          Mz


   1    1  1.048E-08  2.489E-06  7.782E-07  1.908E-10  7.550E-08 -9.766E-06
        2  1.048E-08  1.747E-05  7.415E-07  1.912E-10  7.550E-08 -9.766E-06

   2    2 -3.533E+04 -6.068E-05 -1.888E-06  5.317E+03 -4.526E+04 -4.753E-06
        3 -3.533E+04 -1.041E+07 -1.223E+06  5.317E+03 -4.526E+04 -4.753E-06

   3    3 -3.560E+04 -1.041E+07 -1.223E+06  5.315E+03 -4.504E+04 -6.677E+03
        4 -3.560E+04 -2.077E+07 -2.446E+06  5.315E+03 -4.504E+04 -6.677E+03

   4    4 -3.614E+04 -2.077E+07 -2.445E+06  5.310E+03 -4.461E+04 -3.348E+04
        5 -3.614E+04 -3.103E+07 -3.667E+06  5.310E+03 -4.461E+04 -3.348E+04

   5    5 -3.694E+04 -3.103E+07 -3.667E+06  5.305E+03 -4.395E+04 -9.343E+04
        6 -3.694E+04 -4.114E+07 -4.887E+06  5.305E+03 -4.395E+04 -9.343E+04
```

The .RFI file provides the internal efforts of each element at node I and node J. It contains in particular the bending moment at lower bearing.

V.3.6 .ST File – Stress Min/Max Per Elements

```
SOFIA 2.05                                  SOFIA MODEL
FSA DYNAMIC COEFFICIENTS
test                                                              13-09-18
09:04-----------------------------------------------------------------
El, Node, DevLength, SigCompress, SigTraction
01,  01,  0.000E+00, -1.[illegible],  1.39[illegible]
01,  02,  6.601E+01, [illegible]E-09,  1.39[illegible]
02,  02,  6.601E+01, [illegible].600E-09,  [illegible]
02,  03,  1.320E+0[illegible], [illegible].600E-09,  [illegible]E-09
03,  03,  1.32[illegible], [illegible]2.850E-09,  2.8[illegible]0E-09
03,  04,  1.98[illegible], -2.850E-0[illegible],  [illegible]2.800E-09
04,  04,  1.[illegible]E+02, -1.250E[illegible], [illegible]1.250E+00
04,  05,  3.[illegible]+02, -1.25[illegible]0, -1.250E+00
05,  05,  [illegible]418E+02, -1.[illegible]2,  1.110E+02
05,  06,  [illegible]856E+02, -1.[illegible]0E+02,  1.110E+02
06,  06,  4.856E+02, -2.[illegible]0E+02,  2.230E+02
06,  07,  6.295E+0[illegible] -2.250E+02,  2.230E+02
07,  07,  6.295[illegible] -3.390E+02,  3.370E+02
07,  08,  7.733[illegible]02, -3.390E+02,  3.370E+02
08,  08,  7.733E+02, -4.530E+02,  4.510E+02
08,  09,  9.170E+02, -4.530E+02,  4.510E+02
09,  09,  9.170E+02, -5.670E+02,  5.650E+02
09,  10,  1.061E+03, -5.670E+02,  5.650E+02
10,  10,  1.061E+03, -6.800E+02,  6.780E+02
```

The .ST file provides the maximum and minimum stress value in Unis Stacks of each element of the foil at node I and node J. It is used to quickly check if the foil is overstressed under the load case considered.

V.3.7 .EFI.csv File - Summarized Final Efforts

```
COMPUTATION INFORMATION ;
Model          ; ReferenceFoil ;
Version        ; 2.05.47       ;
Job            ; 01            ;
Date           ; 2019-07-25    ;

GLOBAL REACTION EFFORTS ;
Fx (N)         ; 6.402E+03     ;
Fy (N)         ; 3.017E+04     ;
Fz (N)         ; -1.572E+05    ;
```

The `.EFI.csv` files provides summarized information about global efforts finally computed.

Notice that the `.csv` file format can be directly opened or imported in Microsoft Excel.