SIMA EXAMPLE

How to Run Sima Runtime Engine (SRE) for Sesam Wind Manager

Valid from Sima version 4.6

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How to Run Sima Runtime Engine (SRE) for Sesam Wind Manager

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1 Introduction

This document explains how to run Sima analysis using without graphical user interface with the help of the Sima Runtime Engine (SRE) and Sima Python library (SIMAPY). Particularly, we will run several cases of floating offshore wind turbine (OWT) coupled analysis with different sea states as a preparation to perform time domain fatigue analysis in Sesam Wind Manager. As Sesam Wind Manager receives Wasim export file from Sima, we will also let Sima to do the file management.

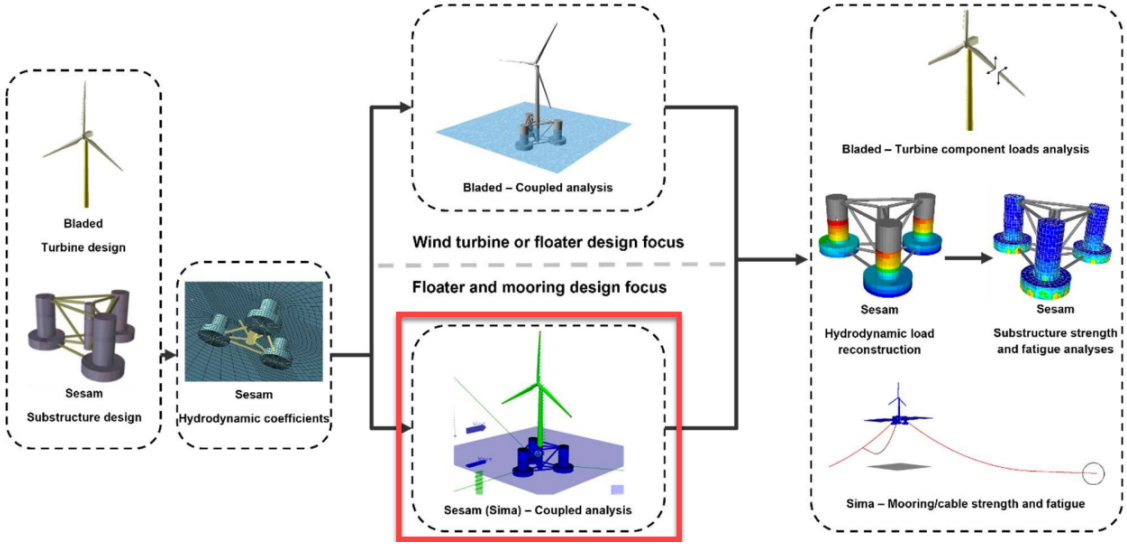

Figure 1-1 Coupled analysis step in Sesam Wind Manager's floating OWT workflow

We will cover the introduction of SRE, preparing the Sima model, running a single simulation with SRE, and running several simulations concurrently with Python script.

2 About SRE

SRE is a separate executable located in the installation folder of Sima. We can use SRE to run certain parts of the program without loading the graphical user interface. Instead, we give SRE command line arguments which specifies what should be done.

Generally, the format of a SRE command in Windows is as follows:

```
sre.exe -data [workspace folder] --[command] [command arguments]
```

where:

- `[workspace folder]` is the location of the workspace directory to run the command in. The folder will be used for files created while executing the command.
- `[command]` is the command to be executed.
- `[command arguments]` is arguments specific to the chosen command.

To get information about the available commands, we can run the following command:

```
sre.exe --help all
```

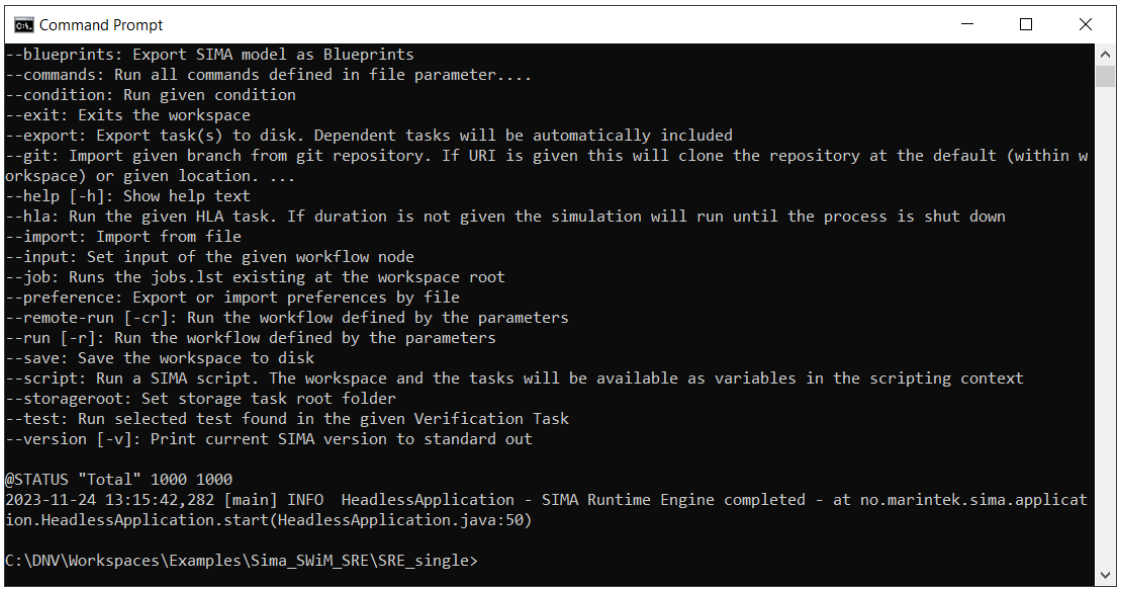

Figure 2-1 Print result of the --help all command

3 Preparing the Sima Model

We will import a Sima model into Sima GUI to prepare it for SRE analysis. Create a new Sima workspace and go to "File → Import → SIMA → SIMA Tasks Archive (stask). Browse the file "FOWT_tutorial.stask" from the input files. Note that this Sima model is the same as the one in the Sesam Wind Manager's FOWT tutorial.

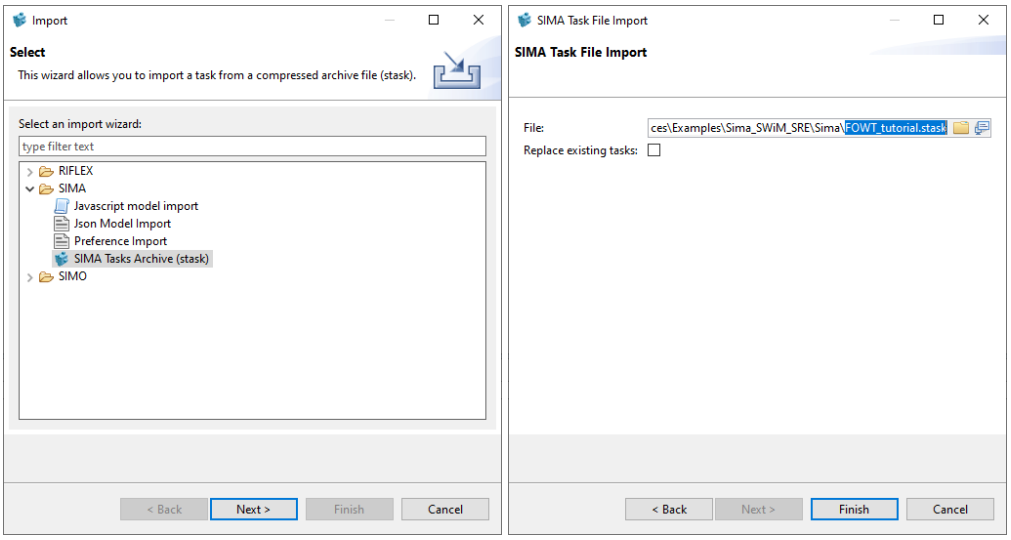

Figure 3-1 Importing the Sima model

Right click the "FOWT_Tutorial" task, select "Open 3D View" to display the model in the 3D viewer. We will not focus on the floating OWT model itself, but we can see that this is a coupled analysis model of a semi-submersible floating OWT. Note that some variables like significant wave height (Hs), peak wave period (Tp), wave direction (WaveDir), etc. have been defined.

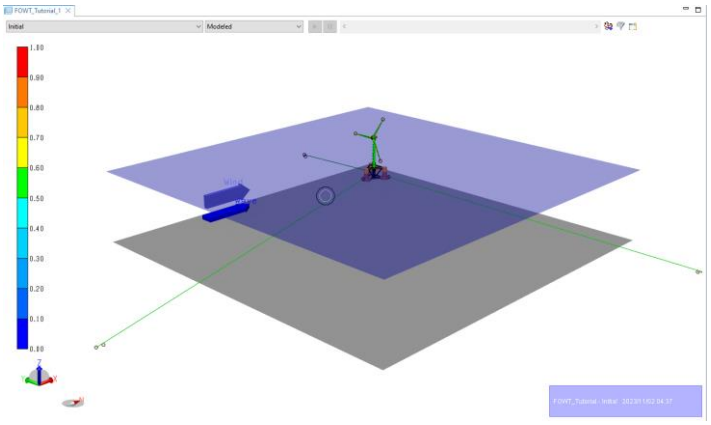

Figure 3-2 3D view of the model

To run the analysis using SRE and copy the Wasim export files to another folder, we will use a *Workflow Task*. We can create the *Workflow Task* from scratch or import it from another model. This time, we will import it from another model. Import the “FOWT_workflow.stask” and open the *workflow* “run_single” by double clicking it.

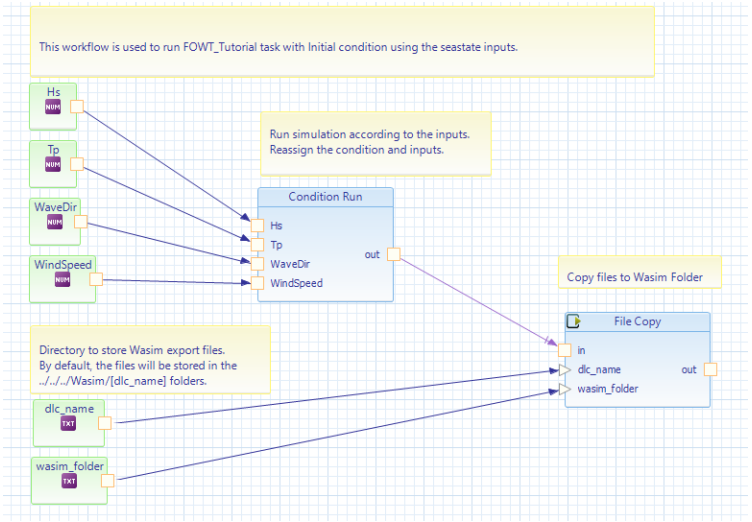

Figure 3-3 Content of the *workflow* “run_single”

Assign condition and inputs in the “Condition Run” step as follows.

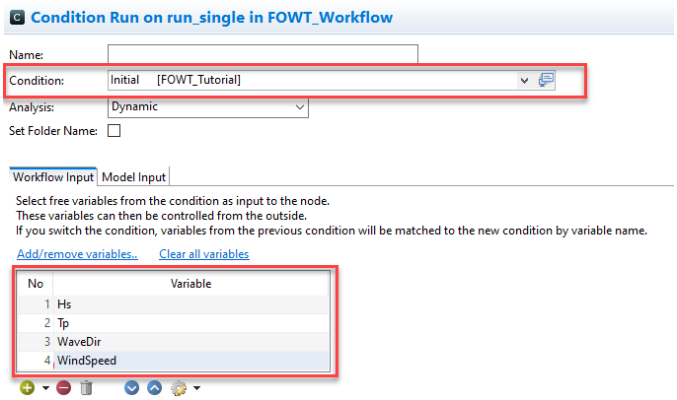

Figure 3-4 Condition and workflow inputs

Export the “FOWT_Workflow” as stask file. Right click the “FOWT_Workflow” task and select “SIMA → SIMA Tasks”. Make sure “Include dependent tasks automatically” is ticked, export as, for example, “SRE_model.stask” file.

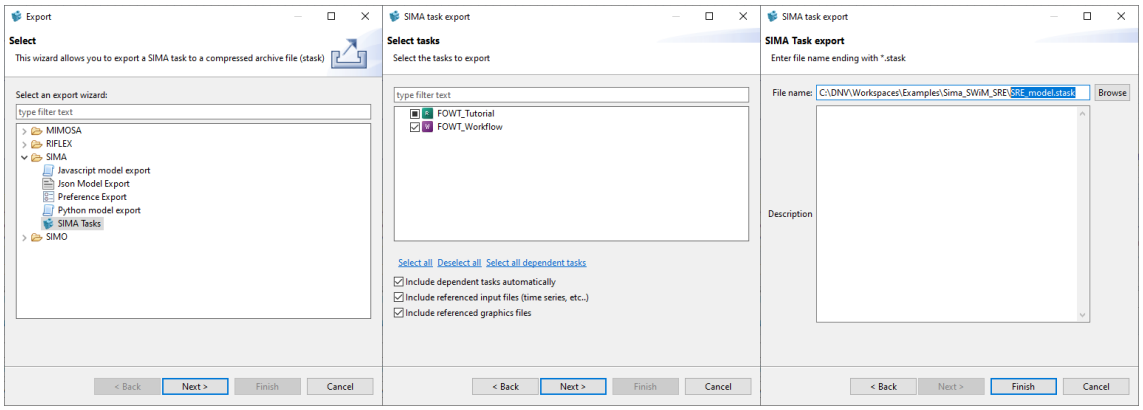

Figure 3-5 Exporting the workflow task

4 Running a Single Simulation with SRE

Firstly, find the location of the SRE executable (sre.exe) in the Sima installation folder. For default Sima V4.6-03 installation folder, the location of the sre.exe is as follows:

```
"C:\Program Files\DNV\Sima V4.6-03\sre.exe"
```

Open Command Prompt (cmd) and navigate to the working directory. For example, we will use the following directory:

```
"C:\DNV\Workspaces\Examples\Sima_SWiM_SRE\SRE_single"
```

Copy the “SRE_model.stask” into this cmd working directory.

Back to cmd, use the following commands to navigate to the above directory:

```
C:
cd "C:\DNV\Workspaces\Examples\Sima_SWiM_SRE\SRE_single"
```

Run SRE with the following command, all in one line:

```
"C:\Program Files\DNV\Sima V4.6-03\sre.exe" -data dlc6-1_b --run
file=SRE_model.stask task=FOWT_Workflow workflow=run_single
input="Hs=6.0;Tp=10.0;WaveDir=0.0;WindSpeed=8.0;wasim_folder="C:\DNV\W
orkspaces\Examples\Sima_SWiM_SRE\SRE_single\wasim";dlc_name=dlc6-1_b"
--exit
```

The above command tells SRE to:

- Set the SRE workspace directory to “dlc6-1_b” folder (`-data dlc6-1_b`)
- Run the “SRE_model.stask” file (`--run file=SRE_model.stask`), with:
  - Select the “FOWT_Workflow” *workflow task* (`task=FOWT_Workflow`),

- Select the “run_single” *workflow* (`workflow=run_single`),
- And use the following inputs (`input=*`):

Input Variable	Value
Hs	6.0 m
Tp	10.0 s
WaveDir	0.0 deg
WindSpeed	8.0 m/s
wasim_folder	"C:\DNV\Workspaces\Examples\Sima_SWiM_SRE\SRE_single\wasim"
dlc_name	dlc6-1_b

- Exit the workspace and save on exit (`--exit`)

After executing the SRE command, some logs will be printed into the cmd while the simulation is running. After the simulation is completed, all the Wasim export files will be copied into the [wasim_folder] path, inside a folder named after the [dlc_name] input.

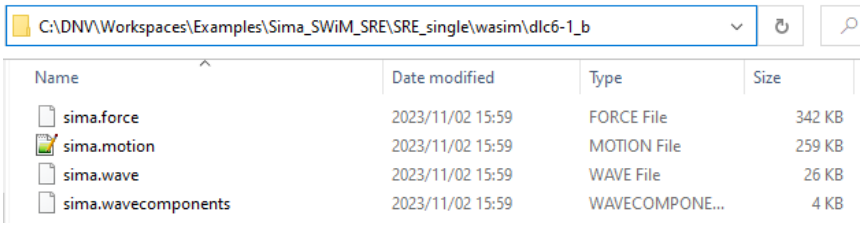

Figure 4-1 Wasim export files inside the newly created wasim folder with the above inputs

5 Running Multiple Simulations Concurrently with Python Script

We can run several simulations concurrently using Python script or any other task schedulers. In this example, we will use Python script and SIMAPY. We will also use a text file listing the design load cases (dlc) and the sea state inputs. Please note that this is a simplified example, and many parts can be improved. Also, the script may not work if iPython like Jupyter Notebook is used.

Create another working directory to work with Python. For example, now we will use the following directory:

`"C:\DNV\Workspaces\Examples\Sima_SWiM_SRE\SRE_multiple"`

Copy the “SRE_model.stask”, “run_multiple.py”, and “caselist.txt” from the input files into the Python working directory. Then, install SIMAPY if it is not installed yet (refer to https://github.com/SINTEF/simapy).

Open the “run_multiple.py” and check the script. The python script consists of the following parts:

- Import of relevant libraries
- General settings where we can set the file paths and maximum number of concurrent simulations.
- Definition of `run_single()` function. This function calls SRE using SIMAPY library and pass the input arguments to SRE for a single case.

- Reading the case list file “caselist.txt”. We will use the input parameters in the file to run the analysis.
- Running `run_single()` function in parallel using `concurrent` library.

Change the general settings accordingly before running the script.

```
12  # General settings (change accordingly)
13  caselist_filename = 'C:\\DNV\\Workspaces\\Examples\\Sima_SWiM_SRE\\SRE_multiple\\caselist.txt'
14  num_concurrent = 2  # Maximum number of concurrent simulations
15  sre_path = 'C:\\Program Files\\DNV\\Sima V4.6-03\\sre.exe'
16  stask_filename = 'C:\\DNV\\Workspaces\\Examples\\Sima_SWiM_SRE\\SRE_multiple\\SRE_model.stask'
17  wasim_folder = 'C:\\DNV\\Workspaces\\Examples\\Sima_SWiM_SRE\\SRE_multiple\\wasim'
```

Figure 5-1 General settings in the Python script

Run the Python script. It will run the cases listed in the “caselist.txt”. If all analyses completed successfully, message “All runs completed successfully” will be printed into the Python terminal.

```
1  dlc_name     Hs   Tp   WaveDir WindSpeed
2  dlc1-1_a     2    4    0       6
3  dlc1-1_b     3    6    0       8
4  dlc6-1_a     6    10   0       14
5  dlc6-1_b     8    12   0       16
```

Figure 5-2 Content of the "caselist.txt"

Go to the Wasim folder location and check if all the Wasim files are there.

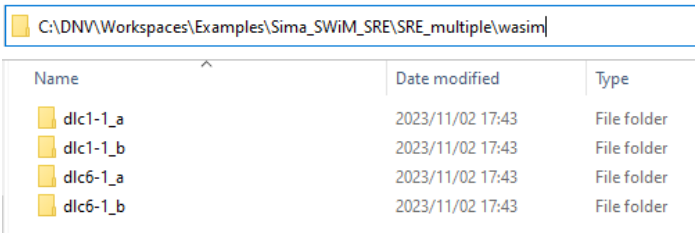

Figure 5-3 Wasim folder at the end of the script execution

We can then copy the contents of the Wasim folder to “_Input” folder in the Sesam Wind Manager workspace and set the Sima Files Folder and Names using autofill based on folder name feature.

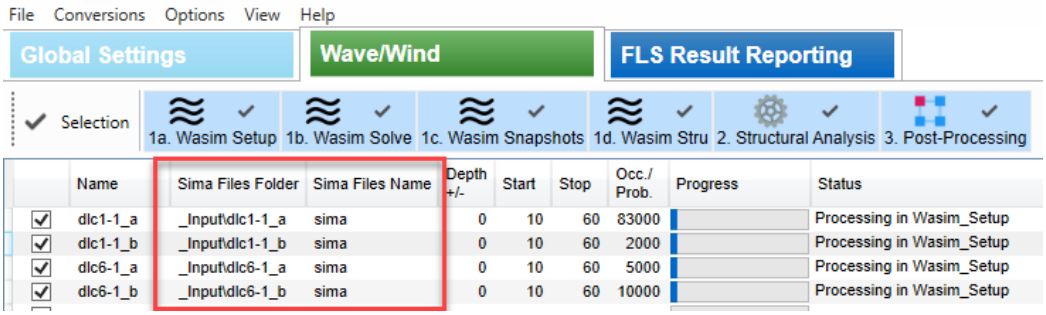

Figure 5-4 Sesam Wind Manager DLC settings

About DNV

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