**USER MANUAL – HAMS-MREL v1.0**

*This manual provides a brief description on the utilization of the open source BEM solver HAMS-MREL*

**Notes:**

1. HAMS-MREL is currently capable of solving the frequency domain diffraction-radiation problem for both single rigid floating structures as well as multiple rigid floating structures (including their interactions).
2. The model description, theory and validation of HAMS-MREL can be found at: <https://doi.org/10.1016/j.renene.2024.121577>.
   1. The case files (Input and Output folder) utilized in this study have been added to the folder ‘Examples\_journal’.
   2. The ‘RunHAMS.bat’ file can be used to run the calculations
3. The pre-compiled versions of the code for both Windows and Linux are provided as part of the repository. These can be found in the folders ‘Linux’ and ‘Windows’ respectively. For the example cases, the Windows pre-compiled version is added in each folder. The pre-compiled versions were created using an Intel Fortran compiler.
4. Python scripts have been added for pre and post-processing. These were created in Python 3.7. It is advised to check this when using a different version of python. The scripts can be modified accordingly if needed.

**Single body simulations**

* For obtaining the solution to the diffraction-radiation problem for a single floating body, the original code created by Dr. Yingyi Liu is adapted in HAMS-MREL.
* In order to create the input files for running the single floating body diffraction-radiation problem, the python script ‘HAMSInput.py’ is available in the ‘HAMSInputOutput/Input/Single\_body’ folder. Three types of input files are required:
  + ControlFile.in – All the input parameters for running the simulation are present here. The user can provide these parameters in the ‘HAMSInput.py’ file and the ‘ControlFile.in’ will be created in the correct format by the python script.
  + Hydrostatic.in-The contains the hydrostatic properties that are utilized to calculate the RAOs. A tool is available (created by Dr. Yingyi Liu, which utilizes a WAMIT mesh to create a HAMS mesh along with the Hydrostatic.in file. This can be found here - <https://github.com/YingyiLiu/HAMS/tree/master/MeshConverter>). Alternatively, if the user knows the hydrostatic properties, he/she can use the function available in ‘HAMSInput.py’ for creating the Hydrostatic.in file in the required format easily.
  + Mesh files – These can be created in WAMIT format using RHINO and then converted to the HAMS mesh using either the aforementioned tool (<https://github.com/YingyiLiu/HAMS/tree/master/MeshConverter>) or the mesh conversion tool BEM-Rosetta (<https://github.com/BEMRosetta/BEMRosetta>).
  + Prior to running the simulation, certain folders needs to be created in the ‘Output’ folder within which the results will be saved. These are performed automatically by the python script ‘HAMSInput.py’
* The output for the single body simulation includes the hydrodynamic coefficients and exciting forces in HAMS, WAMIT and Hydrostar formats. Within the WAMIT format, the wave fields (pressure and free surface elevation) can also be obtained for both the diffraction and radiation the .6p file. The hydrodynamic coefficients and exciting forces can be read using the functions in the python script ‘postprocessing\_functions\_hams\_single\_bodies.py’ in the folder ‘HAMSInputOutput/Output/Single\_body’. As an example on how to use this script, ‘Example\_single\_body.py’ has been added in the same folder. This also shows the RAO and power calculation for a point absorber in the frequency domain.
* **Note: HAMS-MREL is capable of removing irregular frequencies and global symmetry in X or Y direction for single body simulations. This is adapted from the original HAMS.**

**Multi-body simulations**

* In order to create the input files for running the single floating body diffraction-radiation problem, the python script ‘HAMSMultiInput.py’ is available in the ‘HAMSInputOutput/Input/Multi-body’ folder. Two types of input files are required:
  + ControlFile.in – All the input parameters for running the simulation are present here. The user can provide these parameters in the ‘HAMSInput.py’ file and the ‘ControlFile.in’ will be created in the correct format by the python script.
  + Mesh files – These can be created in WAMIT format using RHINO and then converted to the HAMS mesh using either the aforementioned tool (<https://github.com/YingyiLiu/HAMS/tree/master/MeshConverter>) and the mesh conversion tool BEM-Rosetta (<https://github.com/BEMRosetta/BEMRosetta>).
  + Prior to running the simulation, certain folders needs to be created in the ‘Output’ folder within which the results will be saved. These are performed automatically by the python script ‘HAMSInput.py’
* The output of the multiple body simulation includes the hydrodynamic coefficients and exciting forces for all bodies including the interaction terms. The main python scripts for the postprocessing are available in the folder the ‘HAMSInputOutput/Output/Multi-body’ folder – ‘post\_processing\_HAMS\_multibodies.py’ and ‘Multibodies\_HAMS.py’. An example script is added which shows the utilization of these function to retrieve the data and obtain the RAOs for a point absorber array of 3 bodies (‘Obtaining\_RAOs\_from\_HAMS\_PA\_array.py’).
* **Note: Additional features including removal of irregular frequencies, Global symmetry and wave fields (pressure and free surface elevation) will be added in the next release of HAMS-MREL along with the Source Code.**