Contents of the supplementary material — HAF friction model

This folder gathers the material needed to reproduce the quantitative results of the accompanying article: the fitting program (MATLAB and Python), the input data, the complete set of generated results (figures and tables), and the accompanying documentation. Both implementations read the same data and produce the same outputs (identical file names and numbering), and their results coincide.

1. Programs, data and documentation

File	Description
`HAF_model_2026_07_19_21_57.m`	MATLAB program: fits the three-parameter HAF friction model, quantifies every parameter's uncertainty with the BIG bootstrap, and generates Tables 1–4 and all figures. Runs under MATLAB R2016b+ and GNU Octave, without any toolbox.
`python/haf_model.py` (and its time-stamped copy)	Equivalent Python 3 port of the program (numpy, scipy, matplotlib, pandas, openpyxl, pillow).
`SRR_frot_data.csv`	Input dataset: 14 traction curves; columns `rugo;pression;temperature;vitesse;SRR;F`.
`HAF_user_guide_MATLAB_et_Python_....docx`	User guide (this package): how to run each program, input format, options and outputs — Part I for MATLAB/Octave, Part II for Python.
`python/README_2026_07_20_05_15.docx`	Short installation and usage notes for both implementations.

2. Generated results

Folder	Description
`res_matlab/HAF_figures/PNG` and `/BMP`	The 111 figures produced by the program (body Fig. 1–21 and appendix A1–A10), in both formats.
`res_matlab/HAF_tables/`	Tables 1–4 as CSV, plus `HAF_tables.xlsx` (formatted workbook).
`res_python/HAF_python_outputs_2026_07_20_05_28.zip`	Output of the Python run (the same 111 figures and tables), for comparison with the MATLAB run.

3. Reproducibility check

File	Description
`HAF_manuscrit_figures_programme_2026_07_19_23_11.docx`	Demonstration version of the manuscript in which every figure has been replaced by the one generated by the program, allowing a figure-by-figure check of reproducibility.

4. How to navigate — in short

- **Run the code** → open `python/` (Python) or `HAF_model_....m` (MATLAB/Octave), keeping `SRR_frot_data.csv` in the same folder; see the user guide for details.
- **Check the results** → `res_matlab/` (figures and tables) and `res_python/`.
- **Verify reproducibility** → the demonstration manuscript in §3.

Note on the model

Each traction curve is described by the three-parameter HAF form

$$F(\mathrm{SRR}) = 2\,\nu\left(\frac{1}{1+\exp(-h\,\mathrm{SRR})} + a\,\mathrm{SRR} - 0.5\right),$$

with h (hysteresis), a (attrition) and ν (friction level); the dependence of these coefficients on load, temperature, speed and surface state is then described by linear laws and, finally, by a single complete non-linear model. See the user guide for the full description.