

StabFem, a Matlab/Octave interface to FreeFem.

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Abstract :

Developed since 2017, the StabFem project [1,2] is an interface to FreeFem++, combining the powerful capacities of this finite-element software with the versatility of the Matlab/Octave environment. The interface allows to handle each steps of a computation chain (mesh generation and adaptation, simulations and post-processing) using simple commands in command-line or script mode, allowing to gather all the steps of a parametric study within a single main document. The project is collaborative and developed on an open-source and multi-platform basis. Initially targeted towards instability problems in fluid mechanics [2], the project now incorporates a number of other application cases, such as linear acoustics, thermal problems and electromagnetic problems, and the interface is designed as fully customizable to easily incorporate new cases.

The main functionalities of StabFem include:

a/ A generic wrapper to FreeFem programs, with a unified way to pass arguments and manipulate input/output data files.

b/ A graphical plotter allowing the most useful kinds of plots (colorlevels, isolevels, quiver plots...), working directly from the native FreeFem data files, and allowing plotting P2 and P1b data as well as composite data (e.g. a velocity/pressure field defined using [P2,P2,P1] elements) without downgrading.

c/ A database manager, allowing to store all the data generated at all stages of the computation chain, sort them according to user-defined metadata, and reload them for post-processing or subsequent computations.

d/ Finally, a dynamic website [4] allows to publish on the web all studies in the form of html documents containing the code, the explanations and all the results. This website already regroups more than 50 examples of codes, including tutorial examples as well as codes associated to published research papers.

In the presentation, these main functionalities will be detailed and demonstrated.

We then expect to launch a debate among the community of FreeFem+++ developers and users about possible evolutions of the project. In particular, an evolution towards a Python interface is under reflexion. Such an evolution is expected to simplify the coding, improve the robustness, as well as to significantly increase the number of potential users. Our proposition would be to design and develop this future Python interface as a collaborative project, in order to incorporate functionalities fitting the needs of the largest number of users.