Design of a python tool for porous material characterization

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Biot theory is a semi-phenomenological approach to porous materials. It predicts the behavior of a porous medium based on a set of nine to thirteen independant physical parameters.

Some of these parameters are macro-parameters such as the porosity and the resistivity whereas others depends on the micromodel used to define the dissipative effects occuring at the pores level.

Biot's theory provides in particular an expression for the absorption coefficient of the material at a given frequency.

This characteristic of the porous media being easily accessible through an experiment known as Kundt's tube measurement, it is possible to match an analytical curve provided by Biot against an experimental one and thus to extract a plausible expression for each physical parameter defined within the model.

The purpose of the present work is to provide a graphical user interface written in Python which would carry on the matching process and extract conveniently the different physical parameters present in the model. This will be done by the way of a regression carried over the mean quadratic distance between the two curves.

The reliability of the results will be defined. Different micromodels will be used. The efficiency as well as the precision of the different optimizers will be studied.

Finally, some improvement to the initial theoretical model will be proposed, notably including the case of an air gap present during the experiments.

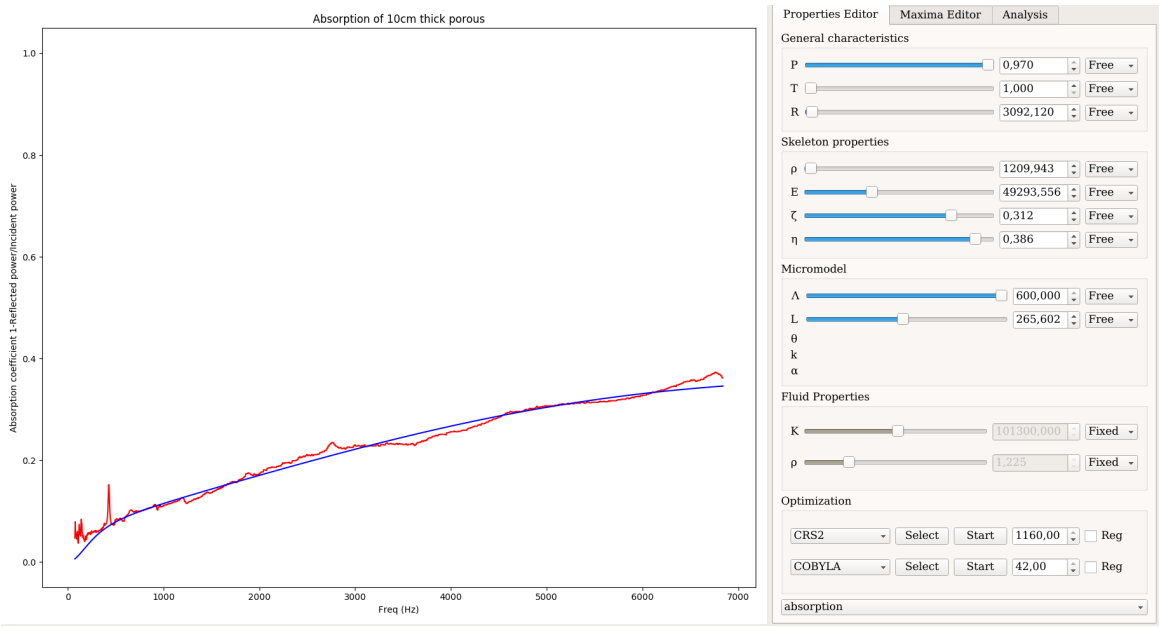

Figure 1: Graphical User Interface