SfePy: finite element analysis software in Python

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Abstract: SfePy is an open source finite element analysis software written primarily in Python programming language, cf. [1]. It was designed to provide a flexible general finite element modeling tool which is easily adaptable to solve problems defined in terms of PDEs systems. A variety of problems treated by SfePy is demonstrated in several examples. In the first one an application concerning shape optimization of closed channels is presented where a criterion is aimed at improving the velocity profile of the Newtonian liquid flow, see [2]. Then a multiscale modeling example follows, originating from the description of a strongly heterogeneous porous medium (e.g. bone) by the theory of homogenization, cf. [3]. In the final example we present some results on modeling so-called phononic materials, elastic periodic structures featured by strong heterogeneities in the elasticity; in the homogenized medium, negative eigenvalues of an effective mass tensor appear for certain frequency ranges, leading to so-called band gaps in acoustic wave propagation, see [4]. The examples are interleaved with general information on SfePy; the choice of the Python is discussed as well as other tools required to install or use the software.

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