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Decoupling technique in poroelasticity problems

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ABSTRACT

In applied mathematical modeling, much attention is given to poroelasticity problems. The basic mathematical models include the Lame equations for displacements and nonstationary equation for the fluid pressure. The most important feature of these mathematical models is that the equations of system are coupled with each other.

For numerical solution of poroelasticity problems various decoupling techniques are used to split the equations for displacement and pressure and solve them separately. At present, four decoupled methods, called the drained, undrained, fixed stress, and fixed strain split, are well-known [1, 2]. But there are no rigorous mathematical results concerning their stability.

We present the decoupling technique based on Samarskii's regularization principle [3]. The stability is achieved by passing to three-level difference scheme and choosing a weight parameter used as a regularization parameter [4].

In our analysis we consider the numerical solution of plate poroelasticity problems, where a fourth-order elliptic equation describes the displacement of a plate. For approximation in space the discontinuous Galerkin finite element methods is used.

References

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