Wavelets preconditioning of a two phases flow problem

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The subject of the research is the development of a wavelets preconditioner to solve the energy balance in the background of the finite element method with embedded meshes.

For each time step, we have a linear system to solve in specific enthalpy variable. At the $n+1$ iteration number, this write

$$L^n H^{n+1} = f^n$$

with

- $L^n = \frac{M}{\Delta t} + A^n$,
- M is the mass matrix,
- A^n is the matrix of the discretization of the differential operator in the finite element framework,
- H^{n+1} is the vector representing the enthalpy,
- and f^n the source vector.

The domain of resolution is a rectangle and we impose a Dirichlet condition on a part of the boundary. We begin with preconditioning the system with Schauder wavelets which take care of the Dirichlet boundary conditions. We have first inverting a coarse matrix with the Choleski direct method and secondly, for the details, we have two strategy:

- preconditioning with a diagonal 2^{-2j},
- or with the inverse of the diagonal of L^n in the wavelet basis.