conclusion

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1 Conclusions

The large number of cells and the high contrast in permeability coefficients make the simulation of flow through porous media an expensive process, in particular for the resulting linear pressure system.

We presented new possibilities to accelerate this process using l.i. systems solutions and POD basis in a deflation procedure. For the POD-based case, we collected system information with a *moving window* approach and with a *training phase* approach.We studied water flooding with injection of water through boundaries and through wells in a heterogeneous porous media, the SPE 10 benchmark. Among the test cases, we included 2D and 3D problems, the latter presenting gravity forces.

For the *l.i. systems* approach, we achieve the solution in two iterations. For the *moving window* and the *training phase* approaches, we reduced the required ICCG number of iterations to $(15-25)\%$ with the deflated version of the same method (DICCG). The best performance was obtained for a 3D case using 10 deflation vectors, for which the required flops per iteration of the DICCG method was twice the flops of the ICCG method. We tested these methodologies for reservoir simulation examples. However, they are nut exclusively applicable to these problems, but could be applied for any transient problem. Furthermore, these methodologies are not exclusive for the PCG method, but could be used for any other linear solvers, e.g., Krylov subspace and Multigrid methods.