

## TP 4 : Richardson solver

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Write a class `RichardsonSolver` such that each object of this class implements the Richardson iterative method for a given set of parameters. This class shall comply with the following specifications :

Data members :

- `double alpha` : relaxation
- `int maxit` : maximum number of iterations
- `double tol` : target relative tolerance of the residual
- `std::vector<double> x0` : initial guess

Functions/member functions :

- constructor taking values for each of the data members.
- copy constructor
- copy assignment operator
- member function `CallBack(const std::vector<double>& r, const std::vector<double>& b, const int& n)` where `r` represents the current residual vector  $\mathbf{r} = \mathbf{A}\mathbf{x} - \mathbf{b}$ , `b` is the right hand side of the linear system to be solved and `n` is the number of the current iteration. The function `CallBack` shall print on a single line the value of the iteration number and the relative quadratic norm of the residual  $|\mathbf{r}|_2/|\mathbf{b}|_2$ .
- `std::vector<double> operator()(const MapMatrix<double>& m, const std::vector<double>& b)` that solves the linear system  $\mathbf{m}\mathbf{x} = \mathbf{b}$  by means of the Richardson's algorithm and returns the approximate solution `x`. It should in addition call the member function `CallBack` at each iteration.
- member function `void SetParam(const double& a, const int& m, const double& t)` that sets `alpha` to `a`, sets `maxit` to `m` and sets `tol` to `t`.
- member function `void SetInitialGuess(const std::vector<double>& x)` that sets `x0` to `x`.