

More Complicated Multigrid Algorithms

The algorithm implemented in the previous lecture is the simplest multigrid scheme with a single *V-cycle*.

Section 19.6 of *Numerical Recipes* discusses various ways of improving this algorithm. There is also a very clear discussion in Chapter 8 of Wesseling's book available on MGNet.

- One can repeat the two-grid iteration more than once. If it is repeated *twice* in each multigrid level one obtains a *W-cycle* type of algorithm.
- The *Full Multigrid Algorithm* starts with the coarsest grid on which the equation can be solved exactly. It then proceeds to finer grids, performing one or more *V-cycles* at each level along the way. *Numerical Recipes* gives a program `mglin(u,n,ncycle)` which accepts the source function $-f$ in the first argument and implements the full multigrid algorithm with $\ell = \log_2(n - 1)$ levels, performing `ncycle` V-cycles at each level, and returning the solution in the array parameter `u`. Note that this program assumes that the number of lattice points in each dimension L is odd, which leads to vertex centered coarsening:

