

High Performance Computing
USN-HCMV , Paris 13
Joint Master 2022

Worksheet 6

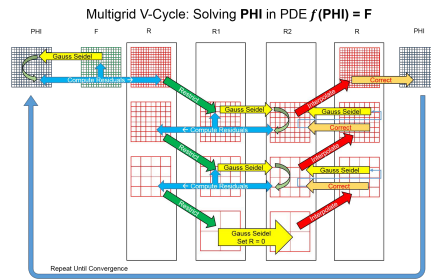


FIGURE 1 – Visualization of iterative Multigrid algorithm for fast $O(n)$ convergence

(https://en.wikipedia.org/wiki/Multigrid_method)

The aim of this session is an introduction to Multigrid

To do : Multigrid : A first tackle

Provided :

- 1) Multigrid-Intro : A first simple " :)" introductory programs to Multigrid
- 2) MGLAB : AN INTERACTIVE MULTIGRID ENVIRONMENT, a matlab software developed by James Bordner and Faisal Saied
- 3) Some basic Matlab programs to solve Lap $u = f$
- 4) Some papers :
 - bordner_saied.pdf : a simple user's guide
 - Lecture Notes by Prof. Halpern
 - A multigrid tutorial

To do :

1. Get to know this solver
2. Show that for the Poisson equation, convergence is independent of h = meshsize for a 3 level V cycle
3. Study the influence of the different smoothers for a V cycle
4. Study the influence of the number of iterations associated to the pre and post smoothers
5. Do the same as above for the W cycle
6. See the effect of a full multigrid.

7. Compare for the different mesh size provided solving the Laplace problem and a convection-diffusion problem with a restarted GMRES and a 3 level V-cycle multigrid.
8. Write a small report about your findings.