Tweed Relaxation: a new multigrid smoother for stretched structured grids THOMAS BEWLEY, Flow Control Lab, Dept of MAE, UC San Diego, ALIREZA MASHAYEKHI, Dept. of Physics, U of Toronto — In DNS/LES of the NSE using a fractional step method, one must accurately solve a Poisson equation for the pressure update at each timestep. This step often represents a significant fraction of the overall computational burden and, when Fourier methods are unavailable, geometric multigrid methods are a preferred choice. When working on an unstretched Cartesian grid, the red-black Gauss-Seidel method is the most efficient multigrid smoother available. When working on a Cartesian grid that is stretched in 1 coordinate direction to provide grid clustering near a wall, zebra relaxation, on sets of lines perpendicular to the wall, is most efficient. When working on a structured grid that is stretched in 2 or 3 coordinate directions, however, one is forced to alternate the directions that the zebra relaxation is applied in order to pass information quickly across all regions of grid clustering. A new relaxation method is introduced which is shown to significantly outperform such alternating direction line smoothers. This new method is implicit along sets of lines that branch and form 90° corners, like the stripes at the shoulder of a tweed shirt, to stay everywhere perpendicular to the nearest wall, thus passing information quickly across all regions of grid clustering.

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