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**Signal Processing Approach to avoid Smoothing Iterations
in Multi-grid Methods**

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Modifications of the conventional multi-grid algorithm are studied to avoid the use of smoothing iterations. In the full multigrid algorithm, classical smoothing iterations (e.g. GaussSeidel) reduce highfrequency components of the error and a coarsegrid approach reduces the lowfrequency components of the error. The problem here is that two methods with different structures are being combined, which introduces additional complexity in the convergence analysis of multigrid methods. Then, the idea is to avoid the use of smoothing iterations by using different intergrid configurations and the concept of quadrature mirror filters, which are well known in the area of signal processing and particularly in wavelet analysis. This framework can be introduced by using the structure of the extended convergence analysis introduced in [1] from which the classical Local Fourier Analysis (LFA) is a particular case. This can provide an integrated configuration to efficiently reduce low and high frequency components of the error as well as aliasing effects between the low- and high- frequency components of the error. The possibility of a direct solver is studied and the conditions under which it can be implemented.

[1]P. Navarrete, and E.J. Coyle, “A semi-algebraic approach that enables the design of inter-grid operators to optimize multigrid convergence,” Numerical Linear Algebra with Applications, Vol. 15, No. 2-3, pp. 219-247, March 2008.