On the Role of the Smoothing Iteration
in the Multi-level Iterative Method

R. Bank

We will consider in detail the role of the smoothing
iteration and its relation to the coarse grid correction in
the context of the finite element formulation of multigrid
(i.e., intergrid transfers and coarse grid matrices defined
in the natural way for finite elements). Within this frame-
work, we give estimates for the spectral radius of two level
schemes (exact coarse grid correction) for self adjoint
positive definite problems on general meshes, and show how
the choice of smoothing affects this rate. The estimates
are shown to be sharp for simple model problems. It is also
shown that certain acceleration techniques applied to the
smoothing iteration asympotically squares the rate of
convergence.