Application of The Strengthened Cauchy-Schwarz Inequality to Wavelet Adaptive Methods for Elliptic Problems

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Abstract: Multilevel methods have been widely applied for the approximation of elliptic partial differential equations using finite element spaces. Recently, owing to the development of the wavelet theory, some methods of multilevel discretization of partial differential equations in a wavelet space have been proposed. It has been pointed out that the main tool in the analysis of multilevel methods is the strengthened Cauchy-Buniakowski-Schwarz inequality. In particular, it has been proved that, if the discrete solution of an elliptic boundary value problem is expanded according to a multilevel decomposition, then its higher level component is an a-posteriori error indicator, which is used to get adaptive methods. To obtain such results the main hypothesis is the strengthened Cauchy-Buniakowski-Schwarz inequality. Some proofs of it already exist for finite element spaces, but the case of wavelet spaces is not yet completely investigated. In this paper the topic is revised and extended to include biorthogonal wavelet spaces.