Meeting: 1000, Albuquerque, New Mexico, SS 10A, Special Session on Multiscale Methods and Sampling in Time-Frequency Analysis

1000-94-17 **Christopher M. Brislawn*** (brislawn@lanl.gov), Los Alamos National Laboratory, Mail Stop B265, Los Alamos, NM 87545, and **Brendt Wohlberg** (brendt@lanl.gov), Los Alamos National Laboratory, Mail Stop B284, Los Alamos, NM 87545. *Matrix theory for the polyphase-with-advance representation of multirate filter banks.*

A matrix theory is developed for the polyphase-with-advance representation that underlies the theory of lifted filter banks and wavelet transforms developed by Sweldens and Daubechies and employed in Part 2 of the ISO JPEG 2000 image coding standard. The theory is used for analyzing linear phase two-channel filter banks via linear phase lifting factorizations. Whole-sample symmetric (WS) and half-sample symmetric (HS) filter banks are characterized in terms of the algebraic properties of their polyphase representations. Our approach emphasizes the simplifying role played by the algebraic groups that arise naturally in the polyphase representation. We obtain new proofs of such results as the invariance of whole-sample symmetry of an input signal under the action of a WS filter bank and the existence of HS lifting factorizations for WS filter banks. These results are generalized to yield new theorems about the effects of HS filter banks on HS input signals. We also study the existence of whole-sample *anti*-symmetric (WA) lifting factorizations for HS filter banks. An interesting finding is that *equal-length* HS filter banks (such as the Haar filter bank) cannot be factored into WA lifting steps and, moreover, arise unavoidably when factoring arbitrary HS filter banks. (Received June 23, 2004)