**FILTER BANK DESIGN WITH GROUP DELAY APPROXIMATIONS**  
(ThuAmOR1)

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| ✩ Abstract : | Multi-rate adaptive filters have been used in various applications with numerous advantages such as low computational load, fast convergence and build in parallelism allowing efficient hardware implementation. Drawbacks when using multi-rate processing are mainly related to aliasing and reconstruction effects. In this paper, a filter bank design method using multi-criteria including inband aliasing, residual aliasing, magnitude and phase constraints on the total filter bank is proposed. The analysis filter bank is first designed with minimum inband aliasing and approximately linear phase in the passband. From a given analysis filter bank, the synthesis filter bank is designed with minimum residual aliasing between subbands while controlling the amplitude and delay distortion level for each frequency component directly. Accurate approximations for the group delay errors are derived for both designed problems.  
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**Abstract:**

By employing these approximations, the multi-criteria optimization problem can be efficiently formulated as quadratic optimization problems. A design example shows that the group delay approximations are highly accurate with the group delay errors restricted to small values.