Investigation of computationally efficient complementary IIR filter pairs with tunable crossover frequency

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References:

Abstract:
This paper concentrates on the computationally efficient implementation of three classes of complementary IIR filter pairs with tunable crossover frequency. Class I denotes the IIR filter pair implemented as a parallel connection of two all-pass filters, whereas Class II (Class III) stands for the tapped cascaded interconnection of two distinct all-pass filters. We propose new tuning formulae for shifting the crossover frequency of the existing filter pair to a new location. The new tuning scheme includes the previously introduced tuning scheme as a special case. The new closed-form expressions representing the sensitivity functions for the amplitude frequency characteristics to the filter constants are developed. The sensitivity functions show that the realization structures of Class II and Class III filter pairs inherently contribute to the low pass-band and the low stop-band sensitivities of those filter classes. We present the approximation of tuning formulae and display the measured amplitude responses obtained on the fixed-point DSP. We show the multiplierless implementation of tap coefficients in Class II and Class III filter pairs.

Keywords:
IIR filters, Complementary filter pairs, Variable filters, Sensitivity analysis