Liu, Qing; Ling, Bingo Wing-Kuen; Dai, Qingyun; Miao, Qing; Liu, Caixia
Optimal maximally decimated m-channel mirrored paraunitary linear phase FIR filter bank design via norm relaxed sequential quadratic programming. (English) Zbl 07394174

Summary: It is worth noting that the conventional maximally decimated \( M \)-channel mirrored paraunitary linear phase finite impulse response condition is defined in the frequency domain. As the frequency domain is a continuous set, it is expressed as a matrix functional (a continuous function of the frequency) equation. On the other hand, this paper expresses the condition as a finite number of discrete (a set of functions of the sampled frequencies) equations. Besides, this paper proposes to sample the magnitude responses of the filters with the total number of the sampled frequencies being more than the filter lengths. Hence, the frequency selectivities of the filters can be controlled more effectively. This filter bank design problem is formulated as an optimization problem in such a way that the total mirrored paraunitary linear phase error is minimized subject to the specifications on the magnitude responses of the filters at these sampling frequencies. However, this optimization problem is highly nonconvex. To address this difficulty, a norm relaxed sequential quadratic programming approach is applied for finding its local optimal solution. By iterating the above procedures using different initial conditions, a near global optimal solution is obtained. Computer numerical simulation results show that our proposed design outperforms the existing designs.

MSC:
58F15 Hyperbolic structures (expanding maps, Anosov systems, etc.) (MSC2000)
58F17 Geodesic and horocycle flows (MSC2000)
53C35 Differential geometry of symmetric spaces

Keywords:
\( M \)-channel mirrored paraunitary linear phase filter bank; optimal design; finite constraints; discrete equality constraints; frequency domain condition; norm relaxed sequential quadratic programming

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References:


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