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Two-Dimensional Symmetric Half-Plane Recursive Doubly Complementary Digital Lattice Filters

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Abstract : This paper deals with the problem of two-dimensional (2-D) recursive doubly complementary (DC) digital filter design. We present a structure of 2-D recursive DC filters by using 2-D symmetric half-plane (SHP) recursive digital all-pass lattice filters (DALFs). The novelty of using 2-D SHP recursive DALFs to construct a 2-D recursive DC digital lattice filter is that the resulting 2-D SHP recursive DC digital lattice filter provides better performance than the existing 2-D SHP recursive DC digital filter. Moreover, the proposed structure possesses a favorable 2-D DC half-band (DC-HB) property that allows about half of the 2-D SHP recursive DALF’s coefficients to be zero. This leads to considerable savings in computational burden for implementation. To ensure the stability of a designed 2-D SHP recursive DC digital lattice filter, some necessary constraints on the phase of the 2-D SHP recursive DALF during the design process are presented. Design of a 2-D diamond-shape decimation/interpolation filter is presented for illustration and comparison.

Keywords : all-pass digital filter, doubly complementary, lattice structure, symmetric half-plane digital filter, sampling rate conversion
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