Robust and direct design for highpass ladder wave digital filters exhibiting equiripple characteristics

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Abstract:

The paper presents a complete direct design method for highpass ladder wave digital filters. The approximation process starts by extracting the properties of the scattering matrix of the reference highpass ladder structures. Accordingly, the transmission function is formulated in the reference frequency domain. Then, it is designed through constructing its squared-absolute. The approximation problem is solved by applying iterative interpolation technique such that equiripple characteristics are obtained in the two bands. The synthesis of the resulting transmission function is carried out by successive partial extraction of the poles at zero, corresponding to transmission zero at dc frequency from the original impedance and successive remainder impedance functions, followed by full extraction of the non-zero poles corresponding to transmission zeros at finite non-zero frequencies from the successive remainder admittance functions. After obtaining the reference structure, the wave digital realization is reached by applying three-port parallel and series adaptors. The method is applied through illustrative examples.

Keywords:

Digital signal processing Digital filters Wave digital filters Highpass ladder structures Straightforward approximation

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