OPTIMAL ANALOG WAVELET BASES CONSTRUCTION USING HYBRID OPTIMIZATION ALGORITHM

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Abstract- An approach for the construction of optimal analog wavelet bases is presented. First, the definition of an analog wavelet is given. Based on the definition and the least-squares error criterion, a general framework for designing optimal analog wavelet bases is established, which is one of difficult nonlinear constrained optimization problems. Then, to solve this problem, a hybrid algorithm by combining chaotic map particle swarm optimization (CPSO) with local sequential quadratic programming (SQP) is proposed. CPSO is an improved PSO in which the saw tooth chaotic map is used to raise its global search ability. CPSO is a global optimizer to search the estimates of the global solution, while the SQP is employed for the local search and refining the estimates. Benefiting from good global search ability of CPSO and powerful local search ability of SQP, a high-precision global optimum in this problem can be gained. Finally, a series of optimal analog wavelet bases are constructed using the hybrid algorithm. The proposed method is tested for various wavelet bases and the improved performance is compared with previous works.

Index Terms- Wavelet transform, Analog wavelet base, Optimization methods, Particle swarm optimization (PSO), Saw tooth chaotic map, Sequential quadratic programming (SQP).