Chapter 4
Fast QRD-RLS Algorithms

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Abstract Although numerically robust, the QR-decomposition recursive least-squares (QRD-RLS) algorithms studied in the previous chapter are computationally intensive, requiring a number of mathematical operations in the order of N^2, or $\mathcal{O}[N^2]$, N being the order of the adaptive filter. This chapter describes the so-called *fast* QRD-RLS algorithms, i.e., those computationally efficient algorithms that, besides keeping the attractive numerical robustness of the family, benefit from the fact that the input signal is a delay line, reducing the complexity to $\mathcal{O}[N]$. The fast versions of the QRD-RLS algorithms using real variables are classified and derived. For each algorithm, we present the final set of equations as well as their pseudo-codes in tables. For the main algorithms, their descriptions are given utilizing complex variables.

4.1 Introduction

Usually the choice of a given adaptive filtering algorithm for an application relies on a number of properties such as speed of convergence, steady-state behavior in stationary environments, and tracking capability in non-stationary environments. However, very often the algorithm choice is highly correlated to its computational complexity. In the case of the recursive least-squares(RLS) family of algorithms, their distinctive features are behavior in finite wordlength implementations and computational burden.

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