ABSTRACT
Consider a possibly vector-valued system of equations
\[ X(k+1) = f(X(k), v(k)), \]
\[ Y(k) = g(X(k), w(k)), \]
where \( v(k), w(k) \) are i.i.d. random sequences, \( g,f \) are well-behaved functions in an appropriate sense, \( Y(k) \) is a measured sequence and unobservable variable \( X(k) \) needs to be inferred from the measured value of \( Y(k) \). Problems of this type (or their continuous time analogues) are generically called filtering problems and they have applications in control engineering, signal processing, econometrics and finance. This work presents a review of time series filtering and its applications in mathematical finance. A summary of results of recent empirical studies with market data are presented for stochastic volatility modelling and yield curve modelling. Different numerically tractable approaches to filtering of nonlinear time series are also outlined.