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A Note on Non-negative Continuous-Time and Discrete-Time ARMA Processes

Abstract: In recent years, a great deal of work has been done on developing suitable models for analyzing the volatility of continuous-time/discrete-time processes. For continuous-time modeling, one general approach is to define a volatility process as the convolution of a kernel with a non-decreasing Levy process, which is non-negative if the kernel is non-negative. Within the framework of continuous-time auto-regressive moving-average (CARMA) processes, we derive a necessary and sufficient condition for the kernel to be non-negative. This condition is defined in terms of the Laplace transform of the CARMA kernel, which has a simple form. We discuss some useful implications of this result and delineate the parametric region of stationarity and a non-negative kernel for some lower-order CARMA models. For discrete-time modeling, the condition of non-negativity is defined in terms of the generating function of the ARMA kernel.