**CARMA Process**

1. **Introduction**

The CARMA models provides a flexible framework for modelling irregular-sampled time series. A zero-mean CARMA process of order is defined according to the stochastic differential equation

Here is a Gaussian white noise process with mean zero and variance . The free parameters in the differential equation are and . A CARMA process is stationary when and the real parts of the roots of the autoregressive polynomial are negative.

A process has a power spectrum given by a ratio of polynomials

and an autocovariance function given by the sum of exponential decays and exponentially damped sinusoids:

* **Explanation**

models have a very flexible parametric form for their power spectrum and autocorrelation function, and because of this they are able to model a broad range of non-deterministic time series. CARMA models therefore provide a flexible framework for analysing irregular sampled time series when some degree of stochasticity is expected. Moreover, they also have the additional advantage that many of the computations involved with fitting, interpolation and forecasting can be efficiently performed using the Kalman Filter and Smoother.

The use of Bayesian inference is important for these models, CARMA models typically exhibit multiple modes in their likelihood function and complicated uncertainties in parameters. This implies that using a single best-fit value and approximating the uncertainties as normally distributed may provide a poor estimate of the uncertainty in the inferred power spectrum and lead to degraded forecasting.