

# Notes for Moreno et al. "AGN VARIABILITY ANALYSIS HANDBOOK"

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## 1. INTRODUCTION

An auto-regressive (AR) process describes a system whose future value can be predicted given a measure of its current state. That is, AR is a form of forecasting. In a typical linear regression ( $y = mx + b$ ) we predict the value of a dependent variable ( $y$ ) based on the value of the independent variable ( $x$ ). In an auto-regressive process we instead predict the future value of the system based on the past value (or values) of the system itself. Thus the dependent and independent variables are the same for example:

$$x_i = \mu + \phi_1 x_{i-1} + \epsilon_i \quad (1)$$

where  $\phi_1$  is the auto-regressive or "lag" coefficient that indicates how closely tied future values are to past values and where  $\epsilon_i$  represents a source of noise.

For Moving Averages (MA) the future system value depends only on the shocks to the system. These can be combined to make ARMA models, which combine short-memory AR responses and MA inputs that govern the "amplitude" of random perturbations at different timescales

For AGN light curves the data is irregularly sampled due to night/seasonal gaps and we have to use continuous processes instead CARMA models.