

We propose a simple stochastic process for modeling improper or noncircular complex-valued signals. The process is a natural extension of a complex-valued autoregressive process, extended to include a widely linear autoregressive term. This process can then capture elliptical, as opposed to circular, stochastic oscillations in a bivariate signal. The process is order one and is more parsimonious than alternative stochastic modeling approaches in the literature. We provide conditions for stationarity, and derive the form of the covariance and relation sequence of this model. We describe how parameter estimation can be efficiently performed both in the time and frequency domain. We demonstrate the practical utility of the process in capturing elliptical oscillations that are naturally present in seismic signals.