There are many ways to formulate the exponential sinusoidal modeling problem. It is important to distinguish between the *stochastic* model, and the *estimator*. A basic element of all approaches is the linear prediction (LP) or autoregressive (AR) relation

$$y_n = \sum_{i=1}^{N} a_i y_{n-i}.$$

Placing this in a statistical framework can yield many variants. I.e. the stochastic AR model

$$y_n = \sum_{i=1}^{N} a_i y_{n-i} + e_n,$$

and a noisy sum-of-sinusoids model

$$x_n = \sum_{i=1}^{N} a_i x_{n-i} \text{ and } y_n = x_n + e_n.$$

The difference between these is that in the former, the noise signal can be seen as driving the input of a dynamical system, while in the latter there is only measurement noise.

For each stochastic model, several estimators can be created. An estimator transforms an observation into a guess for the corresponding parameters, depending on known or estimated statistics.

In the case of the AR model, when the signal covariance matrix is known, the AR model can be solved exactly. It is possible to solve the model in the LS sense, which is equivalent to building an estimate for the signal covariance.