SARIMAX, which stands for Seasonal Autoregressive Integrated Moving Average with Exogenous Variables, is an extension of the SARIMA model that incorporates additional explanatory variables (exogenous variables) into the forecasting process.

Here's a breakdown of the key components and concepts within SARIMAX:

1. Seasonal Component: Similar to SARIMA, SARIMAX includes a seasonal component to capture periodic patterns in the data.
2. Autoregressive (AR) Component: The autoregressive component of SARIMAX models the relationship between the current observation and its lagged (past) values, similar to SARIMA.
3. Integrated (I) Component: The integrated component of SARIMAX refers to differencing the time series data to achieve stationarity, similar to SARIMA.
4. Moving Average (MA) Component: The moving average component of SARIMAX captures the relationship between the current observation and the residual errors of the model, similar to SARIMA.
5. Exogenous Variables: In addition to the components mentioned above, SARIMAX allows for the inclusion of exogenous variables, which are external factors that may influence the time series being forecasted. These variables are independent of the time series being modeled but may have a predictive relationship with it. For example, in weather forecasting, temperature forecasts might include variables such as humidity, wind speed, or atmospheric pressure as exogenous variables.
6. Order Parameters: SARIMAX models still have order parameters (p, d, q) and seasonal order parameters (P, D, Q, m) similar to SARIMA. These parameters determine the number of lagged observations, differencing, and moving average terms included in the model, as well as the seasonal patterns to consider.
    i. p, d, q: These parameters determine the autoregressive (AR), differencing (I), and moving average (MA) orders, respectively, for the endogenous variable.
        a. p: Represents the number of lagged observations used in the AR model, indicating the influence of past values on the current value.
        b. d: Specifies the degree of differencing applied to achieve stationarity in the time series data.
        c. q: Determines the number of lagged forecast errors included in the MA model, capturing the dependency of the current value on past forecast errors.
    ii. P, D, Q, m: These parameters define the seasonal orders for the seasonal autoregressive (SAR), seasonal differencing, and seasonal moving average (SMA) components, respectively, along with the seasonal period.
        a. P: Indicates the number of lagged observations at the seasonal frequency, capturing seasonal patterns in the data.
        b. D: Represents the degree of seasonal differencing applied to the seasonal component to achieve stationarity.
        c. Q: Specifies the number of lagged forecast errors at the seasonal frequency included in the SMA model.
        d. m: Denotes the seasonal period, indicating the number of observations per seasonal cycle.

7. Adjusting these parameters appropriately is crucial for capturing the temporal dependencies and seasonal patterns in the data, ensuring accurate forecasting in SARIMAX models.

By incorporating exogenous variables, SARIMAX models can capture additional information and potentially improve forecasting accuracy by accounting for external factors that may impact the time series being forecasted. This makes SARIMAX a versatile and powerful tool for time series forecasting in various domains, including economics, finance, and meteorology.