

## Wold's Theorem

In statistics, Wold's decomposition or the Wold representation theorem (not to be confused with the Wold theorem that is the discrete-time analog of the Wiener-Khinchin theorem) named after Herman Wold, says that every covariance-stationary time series  $Y_t$  can be written as the sum of two time series, one deterministic and one stochastic.

Formally

$$Y_t = \sum_{j=0}^{\infty} b_j \epsilon_{t-j} + \nu_t$$

where:

- \*  $Y_t$  is the time series being considered,
- \*  $\epsilon$  is an uncorrelated sequence which is the innovation process to the process  $Y_t$ - that is, a white noise process that is input to the linear filter  $\{b_j\}$ .
- \*  $b$  is the *possibly* infinite vector of moving average weights (coefficients or parameters)
- \*  $\nu_t$  is a deterministic time series, such as one represented by a sine wave.