

## PRISM Engine – Lens Reference & Calibration Guide

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(Shortened here for PDF due to size limits — you can request the full expanded version if needed.)  
This document summarizes the PRISM lenses, their mathematical foundations, and calibration methods.

### 1. Correlation Lens

$$\rho = \text{cov}(x,y)/(\sigma_x \sigma_y)$$

### 2. Rolling Correlation

Windowed correlation for structural shifts.

### 3. Covariance Structure Lens

$$\Sigma = (1/(n-1))(X-\mu)(X-\mu)^T$$

### 4. Granger Causality

Tests if lagged x improves prediction of y.

### 5. Lagged Influence Lens

$$\text{CCF}_k = \text{corr}(x_t, y_{t-k})$$

### 6. PCA Lens

Eigenvectors of covariance matrix.

### 7. Eigenvalue Spectrum

Used to measure system complexity.

### 8. Wavelet Lens

Continuous Wavelet Transform (CWT).

### 9. Spectral Power

FFT-based energy distribution.

### 10. Phase-Space Reconstruction

Takens embedding:  $X(t) = [x(t), x(t-\tau), \dots]$

### 11. Lyapunov Exponents

$$\lambda = \lim (1/t) \ln(d(t)/d(0))$$

### 12. Hierarchical Clustering

$$d_{xy} = 1 - |p_{xy}|$$

### 13. K-Means Clustering

Minimizes intra-cluster variance.

### 14. Anomaly Detection

z-score or Isolation Forest.

Calibration Methods Include:

- Synthetic benchmark datasets
- Noise distortion tests
- Null-hypothesis surrogate tests
- Sensitivity analysis
- Cross-lens agreement

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