Workshop 5: Comprehensive Workshop on Linear State Space Modeling

Rajesh Selukar, SAS Institute

This workshop offers a comprehensive and accessible introduction to Linear State Space Models (SSMs), a powerful and interpretable framework for analyzing sequential data such as univariate and multivariate time series, as well as longitudinal and panel data. Designed for researchers and practitioners working with time series data, the session aims to bridge theoretical foundations with practical applications using real-world examples.

Participants will gain a deep understanding of the core components of SSMs, including the Kalman Filter, Kalman Smoother, and Simulation Smoother algorithms. The workshop will explore how an SSM enables meaningful decomposition of time series into latent components—such as trend, seasonality, and regression effects—and support tasks like forecasting, interpolation, and anomaly detection.

The agenda also includes modeling hierarchical and longitudinal data, applying simulation smoothing techniques, and comparing SSMs with alternative approaches such as other classical time series models and modern neural network-based methods. A concise overview of widely used commercial and open-source software will be provided. The illustrations in the workshop use the CSSM procedure from SAS Viya® Econometrics (PROC CSSM documentation). No prior experience with SSMs or SAS is required, although familiarity with time series data and linear regression is recommended.

At the end of the workshop, attendees will be equipped with practical skills and conceptual insights to apply SSMs effectively in their own work, enhancing their ability to model complex time-dependent phenomena with confidence.

References:

- Durbin, J., and Koopman, S. J. (2012). Time Series Analysis by State Space Methods. 2nd Ed. Oxford: Oxford University Press.
- Harvey, A. C. (1989). Forecasting, Structural Time Series Models, and the Kalman Filter. Cambridge: Cambridge University Press.
- Pelagatti, M. M. (2016). Time Series Modeling with Unobserved Components. CRC Press.

Instructor:

Rajesh Selukar, Ph.D., is a Principal Research Statistician Developer at SAS Institute, Inc. In his more than two decades at SAS, he has developed many time series analysis modules including the CSSM and UCM procedures, which are used for SSM-based data analysis.