

**Title: Predicting Propagation from Paths: A Parsimonious, Subordination-Based Framework**

**Speaker: Prof. Vishwakant Malladi, Indian School of Business (ISB)**

**Area: POM**

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**Abstract:**

Service systems, such as health care systems and airline operations, often exhibit strong dependencies among the states of their components. A delay or disruption at one stage can propagate, causing subsequent delays downstream and generating intertemporal correlation across locations. Accurately predicting how such disruptions propagate over time is critical for planning and real-time operations. We develop a parsimonious stochastic framework for prediction called time-lagged partially subordinated Markov chains (TLPSMCs), which enrich continuous-time Markov chains with a time-change that induces flexible intertemporal dependence while preserving tractability. We characterize the resulting intertemporal correlation between components, derive steady-state properties of TLPSMCs, and develop a calibration algorithm that estimates TLPSMC parameters directly from data. We also extend the TLPSMC framework to account for propagation across multiple stages. Focusing explicitly on prediction rather than control, we evaluate our approach in two settings: a tandem queue and an airline network. In both cases, TLPSMC-based predictions of downstream congestion and delay outperform those from simpler, natural benchmark methods. Our results show that TLPSMCs provide a practical and comprehensive framework for modelling and predicting correlation across time in stochastic service systems, enabling managers to forecast future system states and thereby support subsequent decision-making.

**Speaker Profile:**



Vishwakant Malladi is an Assistant Professor of Operations Management at the Indian School of Business (ISB). He obtained his PhD in Risk and Operations Management from the McCombs School of Business, University of Texas at Austin. His research primarily focuses on risk in an operations management context and can be broadly divided into two areas. First, he works on parsimonious modelling of risk in high-dimensional systems using Lévy processes. Second, he studies the impact of risk and risk dependence in operations management problems such as inventory theory, reliability, and the facility location problem. Prior to his doctoral studies, Professor Malladi has worked as a Statistical Analyst for Fractal Analytics and as an Equity Research Analyst for Centrum Capital. He holds a B. Tech in Mechanical Engineering from Indian Institute of Technology (IIT) Bombay and an MBA from Indian Institute of Management (IIM) Ahmedabad.

**Webpage Link:** <https://discover.isb.edu/about/vishwakant-malladi>