"Analysis and Applied Mathematics"
Weekly Online Seminar

<u>Seminar leaders:</u>
Prof. Allaberen Ashyralyev (BAU, Istanbul),
Prof. Michael Ruzhansky (UGent, Ghent),
Prof. Makhmud Sadybekov (IMMM, Almaty)

<u>Date</u>: **Tuesday, February 4, 2025**
<u>Time</u>: 14.00-15.00 (Istanbul) = 12.00-13.00 (Ghent) = 16.00-17.00 (Almaty)

<u>Zoom link</u>: https://us02web.zoom.us/j/6678270445?pwd=SFNmQUIvT0tRaHlDa-VYrN3l5bzJVQT09**, Conference ID:** 667 827 0445, **Access code:** 1

<u>Speaker:</u>
Assoc. Prof. Dr. Betül Hiçdurmaz
Istanbul Medeniyet University, Istanbul, Türkiye

<u>Title:</u> **Completely Monotonic Functions: Driving Innovation in Machine Learning Models**

<u>Abstract</u>: Completely monotonic functions have long been a subject of mathematical and theoretical interest due to their unique properties, including their role in constructing valid kernel functions in machine learning. This talk delves into the mathematical theory behind the Logarithmic Kernel Function (LKF), a novel kernel designed to enhance machine learning models in scenarios with limited training data. LKF is inspired by the well-known radial basis function (RBF) kernel, sharing a Gaussian-like structure while offering superior performance under specific conditions. By leveraging the Mercer condition, this kernel broadens the boundaries of classification and regression tasks, as demonstrated through rigorous experimentation. Using datasets across various domains, the LKF demonstrates its ability to outperform traditional kernels, such as RBF, especially when combined with advanced hyperparameter optimization techniques like the Tree Parzen Estimator.

The talk will also explore the broader implications of completely monotonic functions as kernel candidates within the framework of machine learning theory. These functions provide an avenue for creating innovative kernels with tailored properties, expanding the versatility and adaptability of models to non-linear and high-dimensional data. By bridging mathematical rigor and practical application, this discussion aims to shed light on the potential of completely monotone functions in shaping the future of kernel-based learning algorithms.

Biography:

Betül Hiçdurmaz is an Associate Professor at Istanbul Medeniyet University (Türkiye). She earned her Ph.D. in Applied Mathematics from Gebze Technical University (Türkiye). Her research spans numerical analysis of fractional differential equations, mathematical theory of machine learning algorithms, with applications in life sciences and interdisciplinary studies.