



SEMINAR

Statistical Monitoring of 3-D Parts and High-Dimensional Processes: Spectral Methods and Manifold Fitting

by Enrique del Castillo
Pennsylvania State University



Thursday 22 Oct 2026, 2.30 pm

Dipartimento di Scienze Statistiche - Room Benvenuti

Complex data in industry, enabled by the wide availability of sensors, result in complex, non-Euclidean, and high-dimensional data that require new methodologies for Statistical Process Control (SPC). This talk presents new SPC methods developed in the last few years for discrete parts that are scanned, creating large point clouds, based on intrinsic properties of the scanned surfaces (2-manifolds) that do not require part-to-part registration. This work is based on a particular geometric feature of surfaces, the Laplace-Beltrami spectrum, which is widely used in computer graphics and computer vision. For industries with a large number of different sensors monitoring hundreds of variables and generating dynamic time-series data, a new extrinsic method based on a manifold fitting algorithm is presented. It is shown that the method does not require dimensionality reduction or decorrelation preprocessing, in contrast to manifold learning and PCA-based multivariate SPC methods.



UNIVERSITÀ DI PADOVA
Dipartimento
di Scienze Statistiche

www.stat.unipd.it