



Contribution ID: 32

Type: **not specified**

An Adaptive EWMA Monitoring Scheme for Multivariate Functional Data

Wednesday, 18 September 2024 09:20 (20 minutes)

In modern industrial settings, the complexity of quality characteristics necessitates advanced statistical methods using functional data. This work extends the traditional Exponentially Weighted Moving Average (EWMA) control chart to address the statistical process monitoring (SPM) of multivariate functional data, introducing the Adaptive Multivariate Functional EWMA (AMFEWMA). The AMFEWMA modifies EWMA weighting parameters adaptively to improve the detection sensitivity under various process mean shifts, crucial for industries with dynamic scenarios. The AMFEWMA's advantages over competing methods are assessed through an extensive Monte Carlo simulation and a practical application with the automotive industry in the SPM of resistance spot welding quality through the analysis of dynamic resistance curves across multiple welds, which represent a comprehensive technological signature of the welding process quality. The practical application emphasizes AMFEWMA's potential to enhance SPM in advanced manufacturing.

Acknowledgments: The research activity of A. Lepore and F. Centofanti were carried out within the MICS (Made in Italy –Circular and Sustainable) Extended Partnership and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) –MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.3 –D.D. 1551.11-10-2022, PE00000004). The research activity of B. Palumbo was carried out within the MOST - Sustainable Mobility National Research Center and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) –MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 –D.D. 1033.17-06-2022, CN00000023). This work reflects only the authors' views and opinions, neither the European Union nor the European Commission can be considered responsible for them.

Type of presentation

Talk

Classification

Both methodology and application

Keywords

Functional Data Analysis, Profile Monitoring, Statistical Process Control

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Session Classification: Multivariate statistical process control

Track Classification: Process modelling and Control