Advanced methods in Statistical Process Control

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Abstract. Statistical Process Control (SPC) methods play a key role in Business and Industry, enabling companies to improve quality and reduce costs through data monitoring and corrective actions. A large fraction of SPC activity today is centered around the methods described in the SPC Handbook published by the Western Electric Co. in 1958. Today's data environment, however, is capable of supporting much more sophisticated analytics and decision-making. Advances in statistical theory, especially in the fields of Sequential Analysis, Change-point Analysis and Multivariate Analysis suggest new approaches to implementing SPC, and the course will focus on them.

We plan to cover the following areas:

1. Control procedures based on probabilistic data modeling and application of Likelihood Ratio tests. Within this framework we will cover Cusum procedures and related graphical methods. We will discuss a number of extensions and generalizations, as well as the problem of design and analysis of control schemes. Bayesian methods and related comparisons will also be discussed.

2. Change-point theory and its applications to problems of detection, retrospective data analysis and problem diagnostics.

3. Control of process variability, with emphasis on the problem of control and monitoring variance components.

4. Multivariate monitoring schemes, including Likelihood Ratio detection schemes, Regenerative Likelihood ratio schemes, Regression-adjusted procedures, profile monitoring, procedures based on Variable Selection techniques.

5. The problem of filtering in the presence of abrupt changes, in both univariate and multivariate settings. Application of filtering techniques in situations where direct control action is feasible.

6. Large scale monitoring systems in industrial applications. We will discuss problems related to design and deployment of systems for monitoring Supply Chain data,Warranty and Lifetime data, Semiconductor manufacturing data.