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On Minimum Cost Non-uniform Sampling Schemes for Optimal Design of Control Charts: Application to X-bar and T2 Control Charts

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Abstract

As an economically superior approach to uniform sampling scheme, the pioneering work of Rahim and Banerjee on sampling procedure with non-uniform time intervals has been broadly employed in statistical process monitoring during the past three decades. However, since its consecutive times of inspection have to be determined through a function of the first sampling interval, it might make some kind of complexity in practical administration compare to uniform approach. In this paper, the intuitive companionship between the sampling frequencies and the failure rate of a process is discussed by investigating various functional costraints on choosing the length of sampling intervals and their effects on the optimal design of control charts, especifically for non-Markovian processes which deteriorate over time. Extensive numerical illustrations are prepared for monitoring both univariate and multivariate quality characteristics in manufacturing and service sectors following an increasing failure rate Weibull shock model. Although the proposed structures for sampling intervals could slightly improve the expected cost per unit time, the results illustrated that Rahim-Banerjee model of non-uniform inspection sheme which induces constant integrated hazard over each sampling interval is a well-established near-optimal approach.

Keywords:
Optimization Procedures, Process Failure Mechanism, Integrated Hazard over Sampling Interval, Quality Characteristic(s) Distribution.

Biography

Dr. Mojtaba Aghajanpoorpasha is a Postdoctoral Associate and Sessional Instructor in the Department of Mathematics and Statistics at the University of Calgary, Canada. He earned B.Sc. in Applied Mathematics and M.Sc. in Statistics from Kharazmi University of Iran, and PhD in Statistics from Allameh Tabatab'i University (ATU), Iran. He has published papers in some reputed journals like Operational Research and Communication in Statistics. His research interests include statistical process monitoring, design of experiments, reliability and maintenance, simulation, optimization and industrial statistics. Ranked 1st among PhD researchers in ATU's Faculty of Mathematical Sciences and Computer, he has extensive teaching experience in undergraduate and postgraduate courses at different universities.

Dr. Rob Deardon is an Associate Professor of Biostatistics with a joint position in the Faculty of Veterinary Medicine and Department of Mathematics & Statistics at the University of Calgary. Much of his recent work has been in the area of infectious disease modelling, but he is also interested in Bayesian & computational statistics, experimental design, disease surveillance methods, spatio-temporal modelling, statistical learning and statistical modelling in general. He currently has a research group of around 10 postdocs and research students. He is also currently an associate editor of the Journal of the Royal Statistical Society Series C, Coordinator of the Interdisciplinary Biostatistics Graduate Program at Calgary, and Chair of the Statistics Section of the NSERC Discovery Grant Mathematics & Statistics Evaluation Group. Previous to his post at Calgary he spent 8-years as faculty in the Department of Mathematics and Statistics at the University of Guelph, and postdoctoral positions at the Universities

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