// Abstract

With systems and processes becoming complex, their fault-free functioning—be a factory, a software, a public infrastructure or a digital device running a car—has become vital to sustain an enterprise's growth and prosperity. To this end, new knowledge in seven select domains of quality engineering (QE) has been developed and is reported in this thesis. Studies completed are interdisciplinary, engaging several knowledge domains. In character these range from being analytical (Chapters 3, 4, 5, 6 and 7), to applied—dwelling on the development of new conceptual and mathematical models (Chapter 8), to a new methodology to assess the quality of meta-heuristic solutions to NP-hard decision problems (Chapter 9). These new results have also been disseminated through publications. This thesis is submitted for consideration for the award of Doctor of Science (D Sc) degree by IIT Kharagpur in conformance of the rules set to cover the award of D Sc based on publications.

Results reported cover new QE topics that include new risk indicators for inspection error-inflicted Sequential Probability Ratio Test (SPRT) and imperfect testing of software (SW), new design guidelines for SW development and testing, and new methods that deliver multi-objective robust hardware designs. Other studies included are new techniques to find stochastic bounds for assessing the quality of shop schedules developed by heuristic or meta-heuristic methods, and enrichment of classical Analysis of Variance (ANOVA) for measurement error-afflicted statistical design of experiments (DOE) while assuring a stated overall detection power. In each case, the formulation and/or solution methodology are/is original. This submission is restricted only to the researcher's journal publications in quality engineering.

Keywords:

Extreme Value Theory, Hidden Costs of Poor Quality, Multi-objective Robust Design, Quality Engineering, Risks in Sampling, Sequential Sampling, Statistical models of SW development, Stochastic Bounds for Heuristic Makespan estimates, and Testing and Inspection errors.