Over the past two decades, the Define-Measure-Analyze-Improve-Control (DMAIC) framework of the Six Sigma methodology and a host of statistical tools have been brought to bear on process improvement efforts in today's businesses. However, a major challenge of implementing the Six Sigma methodology is maintaining the process improvements and providing real-time performance feedback and control after solutions are implemented, especially in the presence of multiple process performance objectives. The consideration of a multiplicity of objectives in business and process improvement is commonplace and, quite frankly, necessary. However, balancing the collection of objectives is challenging as the objectives are inextricably linked, and, oftentimes, in conflict.

Previous studies have reported varied success in enhancing the Six Sigma methodology by integrating optimization methods in order to reduce variability. These studies focus these enhancements primarily within the Improve Phase of the Six Sigma methodology, optimizing a single objective. The current research and practice of using the Six Sigma methodology and optimization methods do little to address the real-time feedback and control for online process control in the case of multiple objectives.

This research proposes an innovative integrated Six Sigma multiobjective optimization (SSMO) approach for online process control. It integrates the Six Sigma DMAIC framework with a nature-inspired optimization procedure that iteratively perturbs a set of decision variables providing feedback to the online process, eventually converging to a set of tradeoff process configurations that improves and maintains process stability. The approach is applied to a general business process model - a well-known inventory management model - that is formally defined and specifies various process costs as objective functions. The proposed SSMO approach and the business process model are programmed and incorporated into a software platform. Computational experiments are performed using both three sigma (3σ)-based and six sigma (6σ)-based process control, and the results reveal that the proposed SSMO approach performs far better than the traditional approaches in improving the stability of the process. This research investigation shows the benefits of enhancing and implementing the Six Sigma method for multiobjective optimization and for online process control are immense.

Major: Industrial Engineering

Educational Career:
Bachelor’s of Electrical Engineering, BS, 2005, King Abdul-Aziz University
Master's of Industrial Engineering, MS, 2008, University of Central Florida

Committee in Charge:
Dr. Christopher D. Geiger, Chair, IEMS
Dr. Ahmad Elshennawy, IEMS
Dr. William Thompson, IEMS
Dr. Karla A. Moore, Daytona State College

Approved for distribution by Dr. Christopher D. Geiger, Committee Chair, on May 30, 2013.

The public is welcome to attend.