Noisy Industrial Process Optimisation via Applied Response Surface Methods based on Metaheuristic Elements

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Abstract. Many entrepreneurs face to extreme conditions for instances; costs, quality, sales and services. Moreover, technology has always been intertwined with our demands. Then almost manufacturers or assembling lines adopt it and come out with more complicated process inevitably. At this stage, products and service improvement via a single response, multiple responses or multiple responses with different priorities need to be shifted from competitors with sustainability. Response surface methodology (RSM) is a bundle of mathematical and statistical techniques that are helpful for modelling and analysing such problems. RSM describes how the yield of a process varies with changes in influential parameters. An objective is to optimise the response(s) from a suitable approximation of the unknown relationship. Estimation of such surfaces via a low-order polynomial in some region, and hence identification of near optimal settings for influential parameters via an extended quadratic function is an important practical issue with interesting theoretical aspects. Experimental designs and analyses are engineering strategies to systematically and economically investigate systems. The special forms of designed experiments with application principles consist of factorial, simplex and Taguchi designs. The first-order optimisation approaches include the factorial or Taguchi design based methods (steepest descent or ascent) and simplex design based methods. However, considering the noisy solution space in a specified region, some surfaces contain the global optimum, multiple local optimums or a curved ridge and some are with multiple responses. Metaheuristics are sequential processes that perform exploration and exploitation in the solution space aiming to efficiently find near optimal solutions with natural intelligence of stochastic random searches as a source of inspiration. So, applied response surface methods based on stochastic evolutionary elements including desirability and fuzzy functions are then introduced for solving those noisy, huge and complex problems.

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