The importance of robust design methodology

While a systematic quality strategy is of crucial importance for the success of manufacturing companies, the universal applicability and effectiveness of implemented quality management practices were called into question by a number of major product recalls in recent years. This article seeks to illustrate how already simple analyses and early stage design methods can help to better understand one of the potential reasons for these failures, namely the variation inherent in manufacturing, assembly, and use processes. Usually thoroughly controlled in production, it seems as if particularly the risk of unanticipated variation effects remain largely underestimated and thus unaccounted for in design practice, sometimes with disastrous consequences. To foster the awareness of this variation and to illustrate the benefits of its early consideration in product development, this paper reviews one of the most infamous recalls in automotive history, that of the GM ignition switch, from the perspective of Robust Design. It is investigated if available Robust Design methods such as sensitivity analysis, tolerance stack-ups, design clarity, etc. would have been suitable to account for the performance variation, which has led to a number of fatal product defects and the recall of 30 million vehicles. Furthermore, the disclosed legal case files were examined, offering a unique opportunity to examine how technical malfunctioning of the ignition switch could stay undetected long enough to result in fatalities.