

Optimization of multi response problem of quality characteristics in offset press using experimental design

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Abstract

The offset printing press is widely used in commercial printing companies. The quantity of paper wasted in sheet-fed offset printing is a significant parameter affecting the cost of printed product. The main sources of paper waste are: paper used in machine setup, paper wasted during press running length, over production and printed paper rejected due to quality control. This paper focuses on studying two quality characteristics to reduce rejected printed paper. These quality characteristics are: colour variation and colour mis-registration. Color variation is gauged by variation in ink transfer of the four printing colours: Cyan (C), Magenta (M), Yellow (Y) and Black (K), which are governed by color difference ΔE .

In this study, color variation is measured as a multi response while colour mis-registration is measured as attribute data. The paper presents a study which examines the effect of three process parameters: paper category, batch size and human intervention on investigated quality characteristics of printed product on sheet-fed offset press. The spectrophotometer was employed to measure the color difference ΔE . A full factorial design of experiments was generated with sixteen runs for the above three process parameters with mixed levels. The experimental data was analysed using signal to noise (S/N) ratio, analysis of variance (ANOVA) and main plots to evaluate the factors and their interactions, and to determine the optimal factor level which delivers quality print with minimum paper waste and consequently reduce cost. It is found that the optimal factor level is paper of category 2 printed in small batches and with human intervention. Further, the results of ANOVA reveal that the paper category is the most significant factor affecting paper waste as well as the intervention between paper category and batch size.

Keywords:

Multi Response – quality of offset printing - full factorial design - S/N ratio – ANOVA – color variation – colour mis-registration