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**TITLE OF THE PHD (ENGG.) THESIS:**

**APPLICATIONS OF SOME NEW MULTI-CRITERIA DECISION MAKING  
TOOLS IN MANUFACTURING ENVIRONMENT**

Abstract

The research work explores the applicability and comparative analysis of the recently developed multi criteria decision making (MCDM) tools to improve the quality and consistency of the decision making process in manufacturing environment. To address the limitations involved with conventional methods while solving multiple conflicting criteria and to complement this gap, newly established MCDM methods, MACONT, PROBID, OPTBIAS, PARIS, EAMR and DNMA are combined with objective weighting methods, additionally, PEG and CURLI methods which are independent of criteria weights are explored and applied to five manufacturing environment problems, i.e. 3D printer nozzle material selection, piston material selection, cobot selection, drone selection and dielectric oil selection. Comprehensive comparative analyses like rank comparison, computation of number of operations, Spearman correlation, weighted Spearman correlation coefficient and rank similarity coefficient are carried out and further sensitivity analyses validated the robustness of these methods. Ensemble ranking and Pareto-based analysis were utilized to check method robustness and reliability on a range of weight distributions. DNMA and CRITIC were found as the most suitable MCDM and weighting methods respectively, offering improved ranking consistency and computational efficiency. The framework offers both theoretical and practical contributions because it sets up an extended, comparative, and reproducible approach for assessing next-generation MCDM tools. The results are applicable to the manufacturing environments discussed in this research work. The research limitation includes assumption of deterministic data and lack of application of fuzzy based methods and these are potentially the promising areas for future lines of work. Overall, the research provides an improved methodological foundation for contemporary MCDM application in advanced manufacturing environment.