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Analysis of a robot selection problem using two newly developed hybrid MCDM models of TOPSIS - ARAS and COPRAS - ARAS

Goswami S.S.[a], Behera D.K.[a], Afzal A.[b], Kaladgi A.R.[b], Khan S.A.[c], Rajendran P.[d, e], Subbiah R.[f], Asif M.[g]

Save all to author list

[a] Department of Mechanical Engineering, Indira Gandhi Institute of Technology, Sarang, Odisha, 759146, India

[b] Department of Mechanical Engineering, P. A. College of Engineering, Affiliated to Visvesvaraya Technological University, Belagavi, Mangaluru, Karnataka, 574153, India

[c] Department of Mechanical Engineering, Faculty of Engineering, International Islamic University, Kuala Lumpur, Selangor, 53100, Malaysia

[d] School of Aerospace Engineering, Universiti Sains Malaysia, Engineering Campus, Nibong Tebal, Pulau Pinang, 14300, Malaysia

View additional affiliations

Abstract

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Abstract

Traditional Multi-Criteria Decision Making (MCDM) methods have now become outdated; therefore, most researchers are focusing on more robust hybrid MCDM models that combine two or more MCDM techniques to address decision-making problems. The authors attempted to create two novel hybrid MCDM systems in this paper by integrating Additive Ratio ASsessment (ARAS) with Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and Complex PRoportional ASsessment (COPRAS). To demonstrate the ability and effectiveness of these two hybrid models i.e., TOPSIS - ARAS and COPRAS - ARAS were applied to solve a real-time robot selection problem with 12 alternative robots and five selection criteria, while evaluating the parametric importance using the CRiteria Importance Through Inter criteria Correlation (CRITIC) objective weighting estimation tool. The rankings of the robot alternatives gained from these two hybrid models were also compared to the obtained results from eight other solo MCDM tools. Although the rankings by the applied methods slightly differ from each other, the final outcomes from all of the adopted techniques are consistent enough to suggest that robot 12 is the best choice followed by robot 11, and robot 4 is the worst one among these 12 alternatives. Spearman Correlation Coefficient (SCC) also reveals that the proposed rankings derived from various methods have a strong ranking relationship with one another. Finally, sensitivity analysis was performed to investigate the effects of weight variation and to validate the robustness of the implemented MCDM approaches. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Author keywords

ARAS ; COPRAS ; Hybrid MCDM ; Robot selection ; TOPSIS

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Afzal, A.; Department of Mechanical Engineering, P. A. College of Engineering, Affiliated to Visvesvaraya Technological University, Belagavi, Mangaluru, Karnataka, India;
email:asif.afzal86@gmail.com

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