

# **Dealing with non-reciprocal matrices in the additive and fuzzy preference relations theoretical frameworks**

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## **Abstract-**

**Many multiple-criteria decision aiding methods apply the so-called multiplicative pairwise comparisons, where the comparisons have the form of a ratio expressing how many times one entity is more important (or preferred) than another. Besides the multiplicative system, additive and fuzzy preference relations systems have been proposed for pairwise comparisons in recent decades. These systems are appealing for their intuitive use and natural properties, but they are not as intensively studied as their multiplicative counterpart. Namely, studies on inconsistency and non-reciprocity in particular, in both theoretical frameworks, are rather scarce and fragmented. Therefore, our study focuses on the problem of non-reciprocity in both frameworks and fills the current gaps in its understanding and evaluation. We introduce measures of non-reciprocity in the additive and fuzzy preference relations frameworks compatible with a previously published measure of non-reciprocity in the multiplicative framework, and we show that all measures are specific representations of a general measure of non-reciprocity based on an ALo-group approach. Further on, we show that new measures are endowed with a set of desirable properties. Furthermore, we perform Monte Carlo simulations on randomly generated non-reciprocal matrices both in additive and fuzzy systems and provide percentile tables allowing decision makers to decide whether a level of non-reciprocity of a given PC matrix is acceptable or not.**

**Index Terms-** Additive pairwise comparisons; Consistency; Fuzzy pairwise comparisons; Fuzzy preference relations; Multiple-criteria decision making; Pairwise comparisons; Reciprocity

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**Citation:**

*Mazurek, J.; Linares, P.; Calvo, L.A. "Dealing with non-reciprocal matrices in the additive and fuzzy preference relations theoretical frameworks", International Journal of Approximate Reasoning, vol.187, pp.109540-1-109540-12, December, 2025.*