

ABSTRACT

The present study is focused on second order bipolar fuzzy structures. The concepts such as second order bipolar fuzzy sets and second order bipolar fuzzy topological spaces following both Chang and Lowen sense are introduced. Relations between first and second order bipolar fuzzy topological spaces and relations between crisp topological spaces and second order bipolar fuzzy topological spaces are analysed. Second order bipolar fuzzy continuity is introduced and its properties are discussed. The definitions of first order and second order bipolar fuzzy product topology are introduced. Relations between first and second order bipolar fuzzy product topology and relations between crisp product topology and second order bipolar fuzzy product topology are examined. The concept of first and second order bipolar fuzzy gradation of openness are introduced. A new definition of first order bipolar fuzzy topology induced by first order bipolar fuzzy gradation of openness is given. Relations between first order bipolar fuzzy gradation of openness, second order bipolar fuzzy gradation of openness and first order gradation of openness are discussed. Results related to second order bipolar fuzzy topologies induced by second order bipolar fuzzy gradation of openness are obtained. Five types of second order bipolar fuzzy compactness are introduced. Results related to second order bipolar fuzzy compactness are obtained. Second order bipolar fuzzy matrix is introduced. Operations such as addition, multiplication and complement of second order bipolar fuzzy matrices are given and definitions like transpose, trace and identity of second order bipolar fuzzy matrix are presented. Also properties like associative law and distributive law are verified. The working procedure of second order bipolar fuzzy TOPSIS method is given and an optimal solution for a decision making problem on selecting a best project proposal submitted for project funding is obtained.