Symmetry

an Open Access Journal by MDPI

CiteScore: 5.3
Impact Factor: 2.2

Special Issue Reprint

Symmetry in Classical and Fuzzy Algebraic Hypercompositional Structures

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This book is a collection of 12 innovative research papers in the field of hypercompositional algebra, 7 of them being more theoretically oriented, with the other 5 presenting strong applicative aspects in engineering, control theory, artificial intelligence, and graph theory. Hypercompositional algebra is now a well-established branch of abstract algebra dealing with structures endowed with multi-valued operations, also called hyperoperations, having a set as the result of the interrelation between two elements of the support set. The theoretical papers in this book are principally related to three main topics: (semi)hypergroups, hyperfields, and BCK-algebra. Heidari and Cristea present a natural generalization of breakable semigroups, defining the breakable semihypergroups where every non-empty subset is a subsemihypergroup. Using the fundamental relation β on a hypergroup, some new properties of the β-classes are obtained by De Salvo et al., who introduced and investigated the notion of height of a β-class. Based on the properties of a cyclic hypergroup of particular matrices, Krehlik and Vyroubalova describe the symmetry of lower and upper approximations in certain rough sets connected with this hypergroup. These results suggest an application to the study of detection sensors. In the framework of hyperrings and hyperfields theory, a new line of research has been developed regarding hyperhomographies on Krasner hyperfields, with interesting applications in cryptography (Vahedi et al.) and new fuzzy weak hyperideals were defined in Hv-rings by using the concept of fuzzy multiset (Al Tahan et al.), for which some algebraic properties were obtained. Two articles are dedicated to the study of BCK-algebras. Bordbar et al. present the properties of the relative annihilator in lower BCK-semilattices, whereas several types of intuitionistic fuzzy soft ideals in hyper BCK-algebras were defined and studied by Xin et al. Researchers are interested in the applicative aspects of algebraic hypercompositional structures. For example, new properties related with symmetric relations are emphasized by Chvalina and Smetana for the structures and hyperstructures

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of artificial neurons. Novak et al. present a mathematical model based on elements of algebraic hyperstructure theory, used in the context of underwater wireless sensor networks. A construction of granular structures using m-polar fuzzy hypergraphs and level hypergraphs is illustrated in Luqman et al. using examples from a real-life problem. In the last paper in this book, Akram et al. discuss some properties related to edge regularity for q-rung picture fuzzy graphs.