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CONTENTS

Abstract: This paper introduces free rings, free path groups and free path rings. A *free ring* is a Herstein ring on a free group. A *free group* (denoted $G(\beta, +)$) is a nonempty set G with a binary operation $+$ and a basis $\beta \subseteq G$ so that every member $a \in G$ can be written as a linear combination of the basis elements. A *free path group* G which is a J.H.C. Whitehead homotopy group free on a collection of continuous maps $h : [0, 1] \longrightarrow X$ (called paths) in a path cycle on a space X. Each *path cycle* is a sequence of paths with no end path. A *free path ring* is a Herstein ring on a free path group. The main results in this paper are (1) Every path cycle is realizable as a free path ring (Extension of J.J. Rotman's free group theorem), (2) Every 1-cycle cell complex is realizable as a path cycle and (3) Every 1-cycle is realizable as a free ring (this reverbates back to W. Dyke's 1882 work on the derivation of free groups from circuits on simply connected polygons). Inspired by Lupton-Oprea-Scoville digital fundamental groups, a number of conjectures about the geometric realization of free path rings as structures in digital images and as vector fields are given.

Abstract: Here we present a thorough collection of Opial and Hardy type fractional inequalities involving also convexity, based on Luchko's generalized fractional calculus, and Prabhakar's partial and mixed of variable degree multivariate fractional integrals.

Abstract: Here we investigate the univariate quantitative approximation, ordinary and fractional, of Banach space valued continuous functions on a compact interval or all the real line by quasi-interpola-tion Banach space valued neural network operators. These approximations are derived by establishing Jackson type inequalities involving the modulus of continuity of the engaged function or its Banach space valued high order derivative of fractional derivatives. Our operators are defined by using a density function generated by the Gudermannian sigmoid function. The approximations are pointwise and of the uniform norm. The related Banach space valued feed-forward neural networks are with one hidden layer.

Sehie Park

Abstract: Motivated by the well known work of Rhoades in 1977 on the comparison of various contractive type conditions, the present author in 1980 classified such conditions and obtained several fixed point theorems which cover lots of generalizations of the Banach principle. There we raised five open problems, and then Liu in 1999 resolved two of them negatively. In the present survey, we review several works related to the results of Park and Liu, and suggest to improve them by following our method. Such works are due to Browder, Walter, Tascović, Kirk-Saliga, Jachymski, and Akkouchi.

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