

**NEW FIXED POINT THEOREMS  
FOR SUM OPERATORS IN THE SET  $P_{h,e}$   
AND THEIR APPLICATIONS  
TO NONLINEAR FRACTIONAL DIFFERENTIAL PROBLEMS**

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**ABSTRACT.** The paper presents several new fixed point theorems for some sum operators. Without any compactness or continuity assumptions, we establish sufficient conditions for some operators to have unique fixed points and describe sequences converging to the fixed points. The main results are obtained by the cone theory and monotone iterative technique. Besides, as applications, these new fixed point theorems are used to study the existence and uniqueness of solutions for a class of nonlinear fractional differential equations.

## 1. Introduction

Mixed monotone operators have a great significance for studying nonlinear functional analysis, nonlinear differential equations and integral problems. Since the mixed monotone operators were introduced firstly in [7], there have been interesting and important results about fixed point operators of mixed monotone operators, see [7], [8], [11]–[14], [16], [19], [22], [23].

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