PREFACE

Reflecting on my journey into the fascinating realm of fixed point theory, I am filled with appreciation and excitement. This thesis is the result of years of research, exploration, and an enduring passion for mathematics.

The work in this thesis explores the fixed point theory of various types of contractions and some applications. The thesis is composed of eight chapters, including an introduction and a conclusion. Chapter 1 provides an overview of the fixed point theory. It also includes a review of the existing literature on fixed point theory. This chapter lays the groundwork for the subsequent chapters by presenting the foundational theories.

Chapter 2 presents some common fixed point results for a pair of operators satisfying *Ćirić* quasi-contraction conditions. In the same framework, we study various stability properties. More precisely, we will obtain sufficient conditions assuring that the common fixed point problem is well-posed and has the Ulam–Hyers stability, as well as the Ostrowski property for the considered problem. Moreover, an application to a system composed by an altering point problem and a fixed point problem is presented. A model for these kinds of applications is the hierarchical system of nonlinear variational inequality problems.

Chapter 3 delves into the concept of enriched *Ćirić* quasi-contraction map in the Banach space and obtains the approximating fixed point results for this contraction map. Also, it presents that *Ćirić* quasi-contraction is an unsaturated class of

mappings in the Banach space. In addition, we discuss the enriched Ćirić quasi-contraction in the convex metric space using Takahashi's convexity definition. Furthermore, we present enriched cyclic Ćirić quasi-contraction results in Banach space so that fractal theory may be generated.

Chapter 4 focuses on the existence and approximation of fixed point results of k-strictly pseudo-contractive map using the Krasnoselskii-Mann iteration in the Banach space and we present the same result using the modified Krasnoselskii-Mann iteration. Also, we compare the rate of convergence of these two iterations for the pseudo-contractive map in the Banach space. Utilizing the concept of enriching techniques, it presents that pseudo-contractive is an unsaturated class of mapping in the Banach space.

Chapter 5 advances the concept of the enriched Ćirić-Reich-Rus contraction and Kannan contraction in the quasi-Banach space and obtain their approximating fixed point results and unifying error estimations. Also, we present Maia-type fixed point theorems for enriched Ćirić-Reich-Rus contraction and enriched Kannan contraction mappings in the quasi-Banach space.

Chapter 6 delves into the generalization of Proinov contraction in non-triangular metric space from the metric space. Furthermore, we discuss the existence and uniqueness of a solution of the homogeneous Fredholm integral equation in non-triangular metric space using Proinov contraction.

Chapter 7 presents the existence of strong m-tuple fixed point between m closed subsets of the complete metric space. Using the ideas of the cyclic map and m-tuple fixed point, we introduce Φ-tupling and discuss the existence and uniqueness of strong m-tuple fixed point. Also, we discuss an application of strong m-tuple fixed point theorem for constructing a strong m-tuple fractal through the Φ-iterated tupling system.

This thesis can be seen as a valuable addition to the understanding of fixed point theory for various kinds of contraction in different spaces and their applications. The thesis will attract a wide range of readers, including those interested in functional analysis, operator theory, approximation theory, and the analysis of fractals, etc.