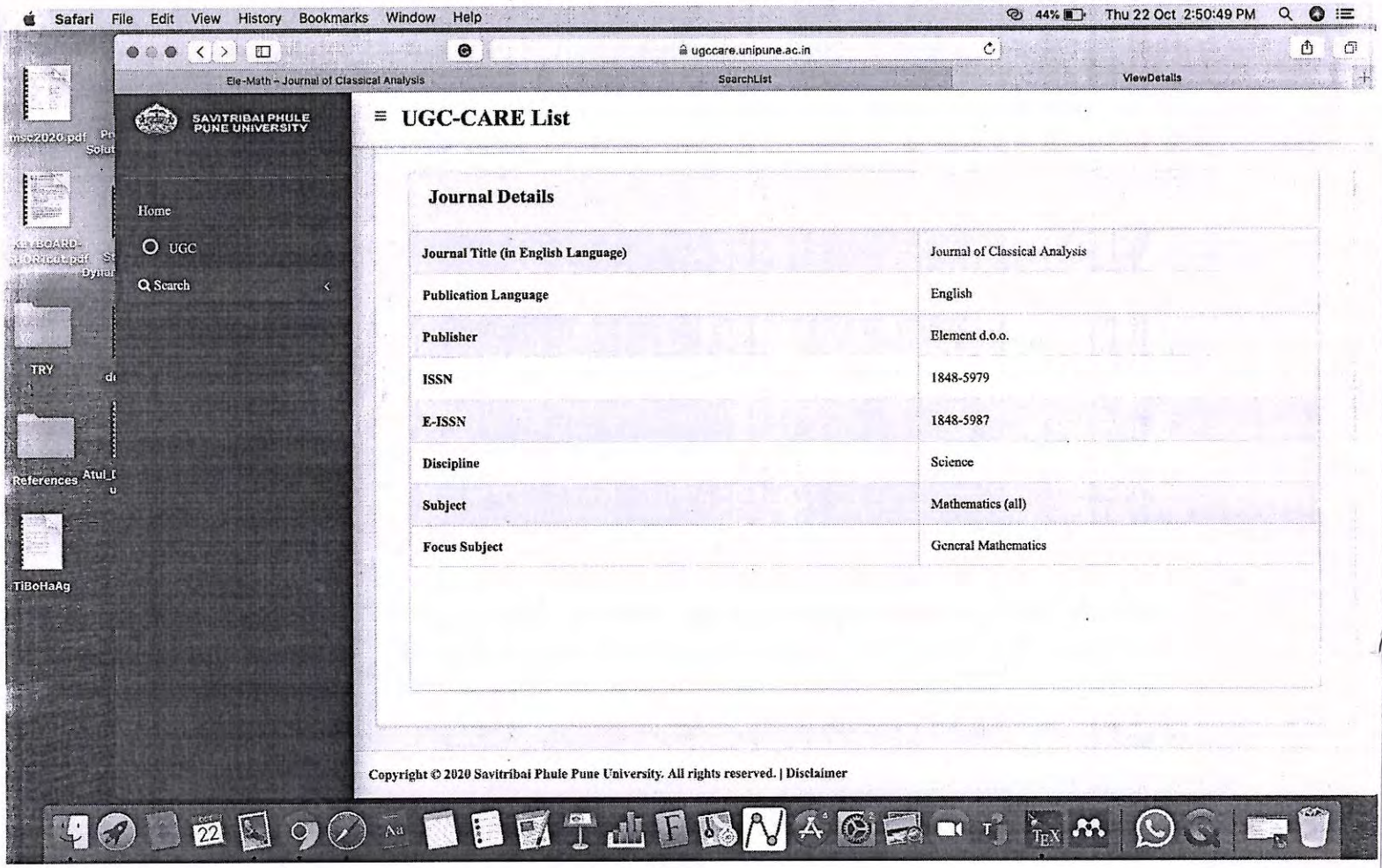

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NONLINEAR DYNAMIC EQUATIONS ON TIME SCALES WITH IMPULSES AND NONLOCAL CONDITIONS

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Abstract. The purpose of this paper is to introduce more general results on the existence of solutions for nonlinear dynamic equations on time scales with impulses and nonlocal initial conditions. We establish the existence of solutions by applying a fixed point result due to O'Regan, while the uniqueness of solutions is obtained through the contraction mapping principle. Our results extend previous work in the literature and an example is discussed to illustrate the obtained results.

1. Introduction

In [28], Hilger introduced the theory of time scales, which unifies the discrete and continuous analysis, and the field also includes quantum calculus as a special case. This theory enables the researchers to study both difference and differential equations under one framework, called dynamic equations on time scales. Dynamic equations on time scales are applicable to either discrete or continuous models, and to those so-called hybrid models that combine discrete and continuous cases. We refer the reader to [1, 11, 12, 13, 14, 16, 38, 39] and references therein for several studies in the context of theory of time scales.

The theory of impulsive dynamic equations provide an excellent tool for the mathematical modelling of various real-world phenomena that involve abrupt changes at certain moments during their evolution; for example, natural disasters, certain diseases, industrial robotics, etc. In particular, work related to impulsive dynamic equations can be observed, see [4, 9, 21, 24, 29, 30, 33]. In the last fifteen years, several researchers and authors have focused their attention to the theory of impulsive dynamic equations on time scales, covering a variety of different problems, for instance, see [5, 15, 22, 23, 26, 27, 40]. This is mainly because of the rich theory of impulsive differential equations, for instance, see, [8, 10, 31, 36, 41] and the applicability of dynamic equations on time scales in various branches of science and engineering, among others, in control system [34], in population dynamics [42], and even in economics theory [6, 7], to mention the few.

However, as per our knowledge, not much has been developed in the direction of impulsive dynamic equations with nonlocal conditions. The mathematical modelling

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