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GENERALIZED QUASILINEARIZATION FOR PBVP THROUGH COUPLED LOWER AND UPPER SOLUTIONS OF THE IVP FOR HYBRID CAPUTO FRACTIONAL DIFFERENTIAL EQUATION

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Abstract. In this paper, we first develop the generalized quasilinearization technique for an initial value problem by using coupled lower and upper solution of type I and use it to obtain the unique solution of a periodic boundary value problem. In order to develop the method of quasilinearization in this set up, we fix either the lower solution or the upper solution. Further, using the method developed for IVP for hybrid Caputo fractional differential equations, we obtain the generalized quasilinearization technique for PBVP and prove the existence of a unique solution under certain criteria.

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1 Introduction

Quasilinearization is an iterative technique that generates a sequence of functions. These sequence of functions are solutions of linear fractional differential equations corresponding to the given problem. The linear fractional differential equations are obtained using the hypothesis of the function f on the right hand side of the considered problem that converge quadratically to the solution of the considered problem. Monotone iterative technique is a flexible technique that provides existence result in a closed set generated by the lower and the upper solutions. In [3] monotone iterative technique for PBVP was developed by constructing monotone sequences, which are solutions of IVPs of linear fractional differential equations corresponding to the given problem. These solutions are unique and hence the monotone sequences so obtained are unique. These sequences converge to a unique function and it is proved to be a solution of considered PBVP. The special advantage of this approach is that working with IVPs of linear differential equations is easy and the existence of the solutions of the PBVP is guaranteed with no extra assumptions.

It has been observed that the notion of coupled lower and upper solutions have been extensively used to develop the monotone iterative technique for nearly all types of upper and lower solutions: natural, coupled upper and solutions of type I