Iterative Solutions for a One-Dimensional $p$-Laplacian Equation

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ABSTRACT

In the past few years much attention was given to the study of one-dimensional $p$-Laplacian equation by using fixed point theorems. This is done by mean of integral representations of the differential equation. (e.g. [1, 2, 3, 4]). However, little was dedicated to the numerical aspects of such integral equations.

Motivated by these works, we study numerical solutions to one-dimensional $p$-Laplacian using iterative arguments and integral representations.

More precisely, we present an iterative scheme for solving the $p$-Laplacian boundary value problem

\[
\begin{cases}
(|u'(t)|^{p-2}u'(t))' + f(t, u(t), u'(t)) = 0, \\
u(0) = u'(1) = 0,
\end{cases}
\]

where $p > 1$ and $f$ is continuous.

An existence theorem is established in $C^1[0,1]$ through Banach fixed point theorem. Some numerical simulations are also presented. The results are partially related to those in [5].

References


