



Viscosity Approximation Methods for Implicit Midpoint Rule of Nonexpansive Mappings in Geodesic Spaces

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Abstract In this paper, we study the convergence theorem of the viscosity technique for the implicit midpoint rule of a nonexpansive mapping T in $CAT(0)$ spaces. Under certain appropriate conditions on $\{\alpha_n\}$, we prove $\{x_n\}$ converges strongly to a fixed point of T which solves some variational inequality. Moreover, we give an application to the minimization problem.

Keywords Viscosity approximation method · Implicit midpoint rule · Nonexpansive mapping · $CAT(0)$ space

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1 Introduction

Let C be a nonempty closed convex subset of a Hilbert space H , let $T : C \rightarrow C$ be a nonexpansive mapping (i.e., $\|Tx - Ty\| \leq \|x - y\|$ for all $x, y \in C$), and let $f : C \rightarrow C$ be a contraction (i.e., $\|f(x) - f(y)\| \leq \alpha\|x - y\|$ for all $x, y \in C$ and some $\alpha \in [0, 1)$). The Moudafi's viscosity method, introduced by Moudafi [1], for nonexpansive mappings generates a sequence $\{x_n\}$ through the iteration process:

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