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THE MODIFIED PROXIMAL POINT ALGORITHM FOR SOLVING THE ZERO-FINDING PROBLEMS OF MAXIMAL MONOTONE OPERATORS IN HILBERT SPACES

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Abstract. In this work, we study two modified proximal point algorithms in the framework of Hilbert spaces. We then prove the strong convergence theorem under some suitable conditions. Finally we provide some examples including numerical results for supporting the main theorem.

Keywords. Proximal point algorithm; Strong convergence; Inclusion problem; Monotone operator; Hilbert spaces.

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1 Introduction

Let $\mathcal{H}$ be a real Hilbert space. Recall that an operator A is said to be *monotone* if $\langle u - v, x - y \rangle \geq 0$, for any $u \in Ax$ and $v \in Ay$. A monotone A is said to be *maximal monotone* if its graph $\{(x, y) : x \in \mathcal{D}(A), y \in Ax\}$ is not properly contained in the graph of any other monotone operator. Let β be a positive real number and let the resolvent of a monotone operator A be denoted by $J_\beta := (I + \beta A)^{-1}$.

One of the major problem in optimization theory is to find $\hat{x} \in \mathcal{D}(A)$ such that $0 \in A\hat{x}$. This problem is often called the *inclusion problem.* It is important because it includes, as spacial, convex programming, minimization problem and linear inverse problem. A well-known method for solving the inclusion problem is the proximal point algorithm (PPA) (see [11]). The PPA generates a sequence as follows:

$$x_{n+1} = J_{\beta_n}(x_n + e_n),\ n \geq 0 \tag{1.1}$$

where $x_0 \in \mathcal{H}$ is a given starting point, $\beta_n \geq \beta > 0$ and (e_n) is the error sequence. It was proved that the PPA converges weakly to a zero point of A. Since then, there have been many modifications of the PPA established in the literature (see, for instance [1, 2, 4, 5, 6, 8, 10, 12, 13, 14, 15]).