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*Forward-Backward-Half forward splitting for solving monotone inclusions*

Tseng's algorithm finds a zero of the sum of a maximally monotone operator and a monotone-Lipschitz operator by evaluating the latter twice per iteration. In this paper, we modify Tseng's algorithm for finding a zero of the sum of three operators, where we add a cocoercive operator to the inclusion. Since the sum of a cocoercive and a monotone-Lipschitz operator is monotone and Lipschitz, we could use Tseng's method for solving this problem, but implementing both operators twice per iteration and without taking into advantage the cocoercivity property of one operator. Instead, in our approach, although the Lipschitz operator must still be evaluated twice, we exploit the cocoercivity of one operator by evaluating it only once per iteration. Moreover, when the cocoercive or monotone-Lipschitz operators are zero it reduces to Tseng's or forward-backward splittings, respectively, unifying in this way both algorithms. In addition, we provide a variable metric version of the proposed method but including asymmetric linear operators in the computation of resolvents and the single-valued operators involved. This approach allows us to extend previous variable metric versions of Tseng's and forward-backward methods and simplify their conditions on the underlying metrics. We also exploit the case when the asymmetric linear operator is triangular by blocks in the primal-dual product space for solving primal-dual composite monotone inclusions, obtaining Gauss-Seidel type algorithms which generalize several primal-dual methods available in the literature.