Projective splitting methods for the sum of monotone operators and the hybrid proximal-projection method

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Many relevant problems in mathematical programming can be formalized a the problem of finding a zero of a maximal monotone operator. For a generic maximal monotone operator, the proximal point method is an theoreticaly effective. It does not prescribe how each proximal subproblem shall be (approximately) solved, but it requires summable errors along the sequence of iterations. Nevertheless, the proximal point method is a general framework for the design and analysis of computational methods for solving particular instances of the inclusion problem.

By interpreting the exact proximal point method as a projection method, an inexact proximal point method with a relative error tolerance can be easily obtained. Moreover, this approach unifies Korpolevich's method and the proximal point method.

Very often, a mathematical programming problem can be formulated as the problem of finding a zero of a sum of maximal monotone operators, where each of the operators has a easily computable resolvent. For this problem, decomposition methods provide algorithms for solving the inclusion problem which deals with each operator separately. Surprisingly, here also projection methods can be used, provided one accept to work in a enlarged space.

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