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Eckstein-Ferris-Pennanen-Robinson duality revisited: paramonotonicity, total Fenchel-Rockafellar duality, and Chambolle-Pock

Finding zeros of the sum of two maximally monotone operators involving a continuous linear operator is a central problem in optimization and monotone operator theory. We revisit the duality framework proposed by Eckstein, Ferris, Pennanen, and Robinson from a quarter of a century ago. Paramonotonicity is identified as a broad condition ensuring that saddle points coincide with the closed convex rectangle formed by the primal and dual solutions. Additionally, we characterize total duality in the subdifferential setting and derive projection formulas for sets that arise in the analysis of the Chambolle-Pock algorithm within the recent framework developed by Bredies, Chenchene, Lorenz, and Naldi.