

# Solving Monotone Inclusions Involving Nonlinear Compositions

Patrick L. Combettes \*

## Abstract

We introduce a framework based on Rockafellar's perturbation theory to analyze and solve general nonsmooth convex minimization and monotone inclusion problems involving nonlinearly composed functions as well as linear compositions. In the context of Banach spaces, the proposed perturbation analysis serves as a foundation for the construction of a dual problem and of a maximally monotone Kuhn–Tucker operator which is decomposable as the sum of simpler monotone operators. In the Hilbertian setting, this decomposition leads to a block-iterative primal-dual algorithm that fully splits all the components of the problem and appears to be the first proximal splitting algorithm for handling nonlinear composite problems.

Joint work with L. M. Briceño-Arias.

---

\*North Carolina State University, Raleigh, NC, USA, [plc@math.ncsu.edu](mailto:plc@math.ncsu.edu)