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Faster solutions to variational inequalities with highly nonuniform component or block Lipschitz constants

Block coordinate methods have a rich history in optimization, particularly for minimization problems, where they offer computational advantages over full vector (single block) methods whenever the problem at hand is compatible with blockwise updates. In contrast, the potential of block coordinate updates remains underexplored in the realm of variational inequalities—a class of equilibrium problems. To date, a rigorous demonstration of computational advantages for block coordinate updates in this context has largely been lacking.

I will present a novel block coordinate method addressing a standard class of variational inequalities with monotone Lipschitz operators. This method achieves a provably lower computational cost than traditional full vector update methods—by a factor scaling with the number of blocks—in settings where blockwise Lipschitz constants are highly nonuniform, which is the very setting where block coordinate methods are known to excel. I will also discuss how this method can be adapted for problems involving finite sum operators, where it functions as a variance reduction method. In this context, and for cases with highly nonuniform Lipschitz constants among the components, the method leads to complexity improvements over state-of-the-art approaches by a factor scaling with the square-root of the number of components in the finite sum.

I will conclude by highlighting some intriguing open questions.

The talk is based on a recent preprint, available here: https://arxiv.org/abs/2411.00979.