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Mixed-Integer PDE Constrained Optimization

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We introduce a new class of complex optimization problems that can be formulated as optimization problems constrained by partial differential equations (PDEs) with integer decision variables. Examples include the remediation of contaminated sites and the maximization of oil recovery; the design of next generation solar cells; the layout design of wind-farms; the design and control of gas networks; disaster recovery; and topology optimization.

We will present emerging applications of mixed-integer PDE-constrained optimization, review existing approaches to solve these problems, and highlight their computational and mathematical challenges. We introduce a new set of benchmarks for this challenging class of problems, and present some early numerical experience using both mixed-integer nonlinear solvers and simple rounding heuristics.