## Covering Linear Programming with Violations

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We consider a class of linear programs involving a set of covering constraints of which at most k are allowed to be violated. We show that this covering linear program with violation is strongly  $\mathcal{NP}$ -hard. In order to improve the performance of mixed-integer programming (MIP) based schemes for these problems, we introduce and analyze a coefficient strengthening scheme, adapt and analyze an existing cutting plane technique, and present a branching technique. Through computational experiments, we empirically verify that these techniques are significantly effective in improving solution times over the CPLEX MIP solver. In particular, we observe that the proposed schemes can cut down solution times from as much as six days to under four hours in some instances.