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The Surprising Performance of Randomized Partial Benders Decomposition

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Benders Decomposition (BD) is a well-known optimization technique for large-scale two-stage mixed-integer problems by decomposing a problem into a pure integer master problem and a continuous separation problem. To accelerate BD, we propose Random Partial Benders Decomposition (RPBD), a decomposition method that randomly retains a subset of the continuous second-stages variables within the master problem. Unlike existing problem-specific partial decomposition approaches, RPBD is universally applicable and simple to implement. We present both computational evidence and theoretical analysis to demonstrate the efficiency and robustness of RPBD.

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