*University of Utah*
UNDERGRADUATE RESEARCH JOURNAL

# STRUCTURAL ROUNDING ON A PARAMETERIZED GRAPH CLASS USING HEURISTICS

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Structural rounding is a framework for approximating NP-hard optimization problems on graphs near structured classes. It has previously been empirically shown to outperform standard 2-approximations for VERTEX COVER on near-bipartite graphs. Though promising, it is unclear if these findings are representative of structural rounding in general since the remainder of the framework's theoretical results have yet to be tested in practice. In this work, we consider the problem of DOMINATING SET on near-bounded treewidth graphs. We engineer structural rounding in this setting and test its performance against a log $\Delta$-approximation algorithm. We implement two treewidth heuristics to improve runtime during editing, at the cost of theoretical guarantees on solution quality. We show that for both methods editing to smaller target treewidth increases edit set sizes but improves overall solution quality, which contradicts structural rounding's previous evaluation.

Roughly, the steps of structural rounding are to **edit** an input graph into a desired structural class, efficiently **solve** the problem on this class, then **lift the** solution onto the original graph. We note that DOMINATING SET is not stable for structural rounding with respect to vertex deletions. We instead approximate ANNOTATED DOMINATING SET which is shown to work with structural rounding under vertex* deletions which emphasize that the rounding process has to pick the set of annotated vertices in the edit set carefully to achieve the associated stability and lifting constants.

Our results demonstrated a setting in which structural rounding performed better as procured edit set sizes grew. This went against our intuition that solving DOMINATING SET exactly on a larger portion of the graph would result in smaller overall solution sizes. We believe this may be explained in part by the necessity of solving ANNOTATED DOMINATING SET. Since annotated vertices are optional to dominate in the partial solution, it is conceivable that this has a greater effect than edit set size. Most significantly, these results give credence to the claim that smaller edit sets do not always lead to better solution quality for structural rounding. These results contrast sharply with those from the framework’s first practical evaluation.