

# MULTILEVEL ALGORITHMS FOR LINEAR ORDERING PROBLEMS

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local minimizations. The M2SP can in fact be used to roughly approximate other functionals.

## INTRODUCTION

Linear ordering problems such as the minimum /p/-sum problem (MpSP), the workbound reduction, the wavefront, the envelope size, etc., appear in many applications of large sparse matrix computation, VLSI design, biological applications, graph drawing, etc. For general graphs these problems are NP-hard. Still, many heuristic algorithms (e.g., Spectral Sequencing, Optimally Oriented Decomposition Tree, Multilevel based, Simulated Annealing, Genetic Hillclimbing, etc.) were developed in order to achieve near optimal solution.

## RESULTS

We present a general framework of linear time multilevel heuristic algorithms (MA) especially designed for linear ordering problems. We demonstrate how the building blocks of the general MA can be used in various ways to make it suitable for solving different functionals. Besides our results for the M1SP and M2SP, we show how the bandwidth of a graph can be approximated by a continuation approach in which a sequence of MpSP solvers are embedded with progressively larger /p/. In addition, we use the M2SP result as a first approximation for the workbound reduction problem, which is then improved by a postprocessing of