# ABSTRACT

In this thesis, we propose a massively parallelizable version of the single level fast multipole method that outperforms the conventional algorithm for large problems. We show that this version of the algorithm has a lower $O(N^{6/5})$ complexity ($N$ denotes the matrix size) as compared to the conventional single level fast multipole method, which scales as $O(N^{3/2})$. We demonstrate that the multilevel fast multipole algorithm (ML-FMA) performs poorly in a parallel setting when dealing with electrically large geometries, due to its overwhelming communication bottleneck among processors. Through numerical examples we demonstrate that the proposed parallel fast multipole method yields smaller memory and time requirements than its multilevel counterpart.