

DAOmap: A Depth-optimal Area Optimization Mapping Algorithm for FPGA Designs

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Technology mapping is a central problem in FPGA synthesis and was extensively studied throughout the 1990s, evolving from early approaches such as Chortle, to depth-optimal algorithms like FlowMap, and later to area-focused techniques such as Praetor. DAOmap marked a major milestone by addressing simultaneous area and delay optimization. Although LUT-based area optimization is provably NP-hard, numerous heuristics have been proposed, among which DAOmap represents a new breakthrough solution. Building on cut-enumeration techniques and effective area propagation from prior work, Chen and Cong introduced several key innovations in DAOmap to tackle this more challenging and practical optimization problem, including differentiated cut-selection strategies for delay-critical and non-critical nodes, solution-space search that incorporates both local and global optimality information, and an iterative cut-selection method that explicitly accounts for node-duplication effects. Experimental results demonstrated a 16% area reduction over the then state-of-the-art CutMap algorithm (and a 38% reduction over FlowMap), while strictly preserving depth optimality. Notably, the iterative cut-selection technique with node-duplication awareness has since become a proven approach adopted in modern FPGA synthesis tools. This paper has received over 215 citations.

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