A Study of Extending Transformation-based Synthesis to Incompletely-specified Functions

D. Michael Miller  
Department of Computer Science  
University of Victoria  
Victoria, BC, Canada  
Email: mmiller@uvic.ca

Mitchell A. Thornton  
Darwin Deason Institute for Cyber Security  
Southern Methodist University  
Dallas, TX, USA  
Email: mitch@smu.edu

Abstract—Given a completely-specified reversible function, existing transformation-based synthesis (TBS) methods find a reversible circuit that can then be mapped to a quantum circuit. This paper presents a preliminary study of extending the basic TBS method, and a variant of the method that uses Reed-Muller spectra, to integrate the assignment of don’t-cares (DC) into the synthesis process, thus extending the TBS methods to handle incompletely-specified reversible functions. This approach is an alternative to assigning DC as a pre-synthesis step. The new methods facilitate the embedding of an irreversible function into a reversible specification thus allowing for the synthesis of a reversible circuit and subsequently a quantum circuit implementing the irreversible function.

Experimental results are given that demonstrate the operation of the proposed methods as well as their limitations. A number of areas are identified for further research.

REFERENCES