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Y. Qin et al.Complementary Synthesis for Encoder with Flow Control Mechanism

Complementary Synthesis for Encoder with Flow Control Mechanism YING QIN and QINGBO WU and HUADONG DAI and YAN JIA and SHENGYU SHEN School of Computer, National University of Defense Technology

abstract Complementary synthesis automatically generates an encoder's decoder with the assumption that the encoder's all input variables can always be uniquely determined by a bounded sequence of its output variables. However, many modern encoders employ flow control mechanism that inserts invalid data into the encoder's input sequence, which prevents some input variables from being uniquely determined. None of the current algorithms can handle such cases.

Flow control mechanisms classify the encoder's input variables into two sets: the flow control variables that can always be uniquely determined, and the input data variables whose validness is indicated by a predicate over the flow control variables. When the input data variables are invalid, the decoder is supposed to recognize its invalidness by recovering the flow control variables and ignoring the input data variables.

Thus, a novel algorithm is proposed for the first time to handle such encoders with flow control mechanism. First, it identifies all variables that can be uniquely determined, and take them as flow control variables. Second, it infers a predicate over these flow control variables that enables all other input data variables to be uniquely determined. Third, it characterizes the decoder's Boolean function for each input variable, by first building a conjunction of two formulas that assign conflicting values to this input variable, and then generating a Craig interpolant from its unsatisfiability proof. In addition, for the input data variables, the inferred predicate must be enforced before generating Craig interpolant.

Experimental results on several complex encoders indicate that our algorithm can always correctly identify the flow control variables, infer the predicates and generate the decoder's Boolean functions.