

Observational Analysis of Memory Elements in Sequential Circuits

This study presents a method for analyzing the memory behavior of sequential circuits by observing how outputs depend on past inputs, without requiring structural descriptions. Unlike combinational circuits, which produce outputs solely from current inputs, sequential circuits are modeled as causal functions, capturing their dependence on input history. By introducing functional type expressions and domain restriction techniques, we describe how memory elements access past inputs over time. This approach enables a precise, semantically grounded analysis of sequential behavior based purely on external input-output relations, offering new insight into how memory operates within digital systems.