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MEALY FINITE STATE MACHINES: AN EVOLUTIONARY APPROACH

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Abstract. *Synchronous finite state machines are very important for digital sequential designs. Among other important aspects, they represent a powerful way for synchronising hardware components so that these components may cooperate adequately in the fulfillment of the main objective of the hardware design. In this paper, we propose an evolutionary methodology synthesis finite state machines. First, we optimally solve the state assignment NP-complete problem, which is inherent to designing any synchronous finite state machines using genetic algorithms. This is motivated by the fact that with an optimal state assignment one can physically implement the state machine in question using a minimal hardware area and response time. Second, with the optimal state assignment provided, we propose to use the evolutionary methodology to yield optimal evolvable hardware that implements the state machine control component. The evolved hardware requires a minimal hardware area and introduces a minimal propagation delay of the machine output signals.*
Keywords: Mealy machine, Synthesis, State assignment, Genetic algorithms.

1. **Introduction.** Sequential digital systems or simply finite state machines have two main characteristics: there is at least one feedback path from the system output signal to the system input signals; and there is a memory capability that allows the system to determine current and future output signal values based on the previous input and output signal values [15].

Traditionally, the design process of a state machine passes through five main steps, wherein the second and third steps may be bypassed as shown in Figure 1:

1. the specification of the sequential system, which should determine the next states and outputs of every present state of the machine. This is done using state tables and state diagrams;
2. the state reduction, which should reduce the number of present states using equivalence and output class grouping;