The Theory of Computation

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Solution Manual
Chapter 4, Problem 5.8

The equivalence has to be understood in somewhat loose terms, since our Turing machines compute functions, but our finite automata only decide membership in languages.o

In abstract terms, though, the answer is quite clear: our restricted TM *is* a finite-state machine! If we examine what defines the state of the computation carried out by such a machine, we see that it is the input string, the contents of the current tape square (which could be different), and the current control state. Whatever is to the left of the head is irrelevant, since the machine can never look at it again; what is to the right of the head is simply the rest of the input, just as in a finite-state machine. So the only apparent difference is that our restricted Turing machine could sit on the same square and alter it several times before moving on. But we have seen that a finite automaton can have ε transitions during which it does not consume an input symbol; and the number of transitions that can be taken by our Turing machine before moving to the next input symbol is a constant—it is bounded by the product of the number of control states by the number of tape symbols, so that the finite automaton can encode all of them in its finite-state control.

Thus, in the loose understanding mentioned above, the two models are indeed equivalent.