RELATIONS ON MONOIDS AND MINIMAL REALIZATION THEORY FOR DYNAMIC SYSTEMS; APPLICATIONS FOR FUZZY SYSTEMS

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In this paper, a new approach is given for the realization theory of dynamical systems generated by monoid actions. This theory will include, as a particular case, the classical realization theory taking into account free monoid actions.

The equivalence between the category of reachable systems (with a given behaviour) and a category of right congruences on a monoid M is established. This approach enables us to see the role played by the Nerode equivalence in the minimal realization theory. At the same time, our results show that the minimal realization is isomorphic to a direct limit of realizations.

The same techniques are used to clarify the importance of the Myhill realization of a given behaviour. Here, the category of right congruences on M is replaced by a category of two-sided congruences on M. The latter one is proved to be equivalent to the category of reachable systems with a given behaviour, whose state space is a monoid and whose reachability map is a monoid homomorphism.

The Myhill realization is then the final object of this later category and, at the same time, it can be viewed as a direct limit too.