# AUTOMATIC RULE GENERATION OF FUZZY LOGIC CONTROLLERS BASED ON ASYNCHRONOUS COEVOLUTION OF RULE-LEVEL SUBPOPULATIONS

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**ABSTRACT**—This paper proposes a rule-level coevolutionary approach based on multiple subpopulations to evolve fuzzy logic controllers (FLCs). Each rule is used as an individual and the subpopulations, each comprising a number of candidate rules, are randomly probed for evolution [asynchronous coevolution] via evolution strategy (ES). The rules belonging to the same subpopulation compete while those in different subpopulations cooperate to achieve the goal of finding a better FLC. During this process, the rules within each subpopulation become specialized into a kind of expert in the corresponding problem domain. For this approach, a simple credit assignment scheme for rule evaluation is introduced to reduce the search space effectively. The superiority of the proposed algorithm over traditional FLC-level evolution approaches has been demonstrated by evolving FLCs for two typical nonlinear control problems - the ball-and-beam and the cart-pole systems.

*Key Words:*  fuzzy logic control, rule generation, asynchronous coevolution, subpopulation, ball-and-beam, cart-pole.