A new definition of Neuro-Fuzzy Dynamical Systems is introduced, using the concept of Fuzzy Dynamical Systems (FDS) in conjunction with High Order Neural Network Functions (F-HONNFs). The dynamical System is assumed nonlinear and totally unknown. First its approximation by a special form of a fuzzy dynamical system (FDS) is proposed and in the sequel the fuzzy rules are approximated by appropriate HONNF's. Thus the identification scheme leads to a Recurrent High Order Neural Network, which however, takes into account the fuzzy output partitions of the initial FDS. The proposed scheme does not require a priori experts' information on the number and type of input variable membership functions, making it less vulnerable to initial design assumptions.

After the identification process the system can be adaptively controled either directly or indirectly. By doing so, weight updating laws for the involved HONNs are presented. With rigorous proofs it is guaranteed that the errors converge to zero exponentially fast, or at least become uniformly ultimately bounded. At the same time the stability is guaranteed by proving that all signals in the closed loop remain bounded.

During both the identification and control process it is assumed that we know the centers of output membership functions, and we identify the HONN parameters in which case we get a directional variation. Thus in order to guarantee existence of the control law, a new method is defined replacing the well known projection, which is termed parameter hopping and thus it is rigorously proved the existence of the control law, guaranteeing stability properties.