Abstracts

Structural determination of multilayered large-signal neural-network HEMT model

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This paper reports on the structure of a large-signal neural-network (NN) high electron-mobility transistor (HEMT) model as determined by a pruning technique and a genetic algorithm. The bias-dependent intrinsic elements of an HEMT's equivalent circuit are described by a generalized multilayered NN whose inputs are the gate-to-source bias (V/sub gs/) and the drain-to-source bias (V/sub ds/). Using C/sub gs/ data as an example, we began by experimentally examining some of the features of the multilayered NN model to obtain rules-of-thumb on choosing training parameters and other information for succeeding studies. We then developed and studied a novel pruning technique to optimize the C/sub gs/ NN model. Excessively large NN configurations can be reduced to an appropriate size by means of a weight decay, which is based on the analysis of a synaptic connection's activity. Finally, we employed a genetic algorithm for the same purpose. By representing the configuration of a standard multilayered NN as a chromosome, the optimum configuration of a C/sub gs/ model was obtained through a simulated evolution process. For this approach, the configuration of an NN that simultaneously represents seven intrinsic elements (C/sub gs/,R/sub i/,...,C/sub ds/) of an equivalent circuit was also shown for comparison to previous work. We successfully obtained simplified NN models using both approaches. The advantages and disadvantages of these two approaches are discussed in the conclusion. To our knowledge, this is the first report to clarify the general process of building an NN device model.

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