

Adaptive Analog MOS Neural-Type Junction*

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ABSTRACT

Using the CMOS threshold adjust circuit recently presented in [1], this paper develops an adaptive analog neural-type junction. The junction itself is based upon the circuits presented in [2] and works according to charge control theory discussed in [2].

DEVELOPMENT

Current research trends concentrate upon means of adapting weights in analog neural networks. The main problem facing hardware designers is the feasibility of large scale implementations when adaptation is incorporated. Here we present a system which readily lends itself to simple VLSI implementation.

Figure 1 shows the input weighting stage including threshold adjustment where V_c is the threshold adjust parameter. This weighting stage is the three terminal device labelled G-D-S. The circuit of Fig. 1 is inserted into the neural-type junction of Fig. 2 at the correspondingly labelled points. It is noted that D, G, and S represent the drain, gate, and source of the input transistor being replaced in the original junction of [2].

The threshold adjust circuit accomplishes threshold voltage adjustments in order to modify the connection weights which determine the level of transmission from one neuron's output to another neuron's input. As discussed in the paper of 1987 [1], double gate MOS structures can be used to capture the adaptive properties of biological neurons. However, in present day technology the double gate transistor is relatively inconvenient to use. The circuit of Fig. 1 avoids this inconvenience by expeditiously employing the charge control concept. In Fig. 1 charge flows into the gate g and via the parasitics fixes the amount of charge on the right hand transistor. This right hand transistor acts as a normal transistor but with its characteristics controlled by V_c . This is to say, the I-V characteristics of the three terminal device labelled G-D-S are the same as those of a normal MOS transistor but shifted through the threshold adjust parameter V_c .

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References:

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- [2]. N. El-Leithy, R. W. Newcomb, and M. Zaghloul, "A Basic MOS Neural-Type Junction; A Perspective on Neural-Type Microsystems," Proceedings of the IEEE First International Conference on Neural Networks, San Diego, CA, June 1987, pp. III-469 - III-477.

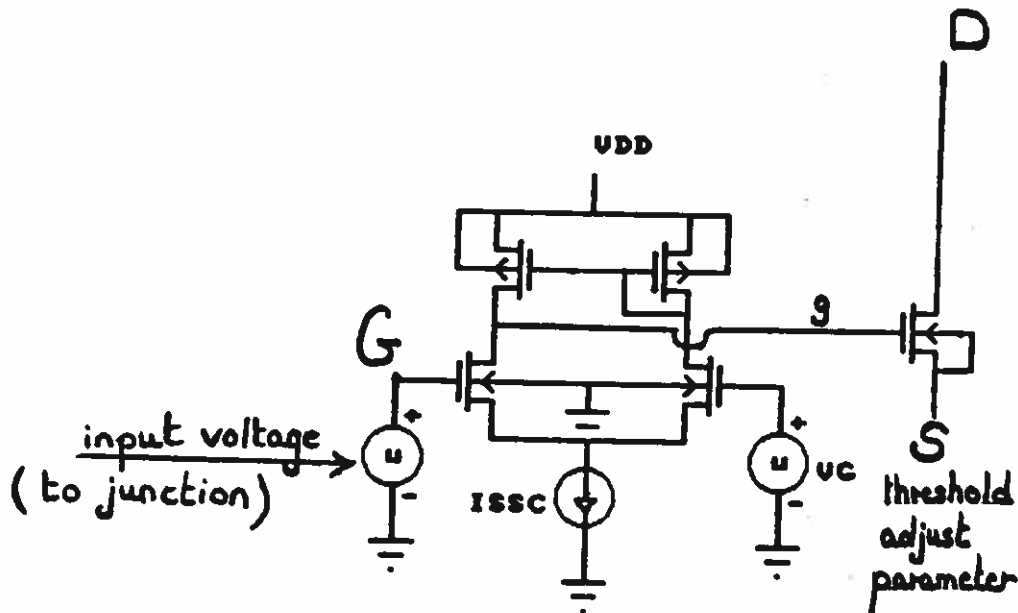


FIGURE 1
THRESHOLD ADJUST CIRCUIT

VOLUME

2

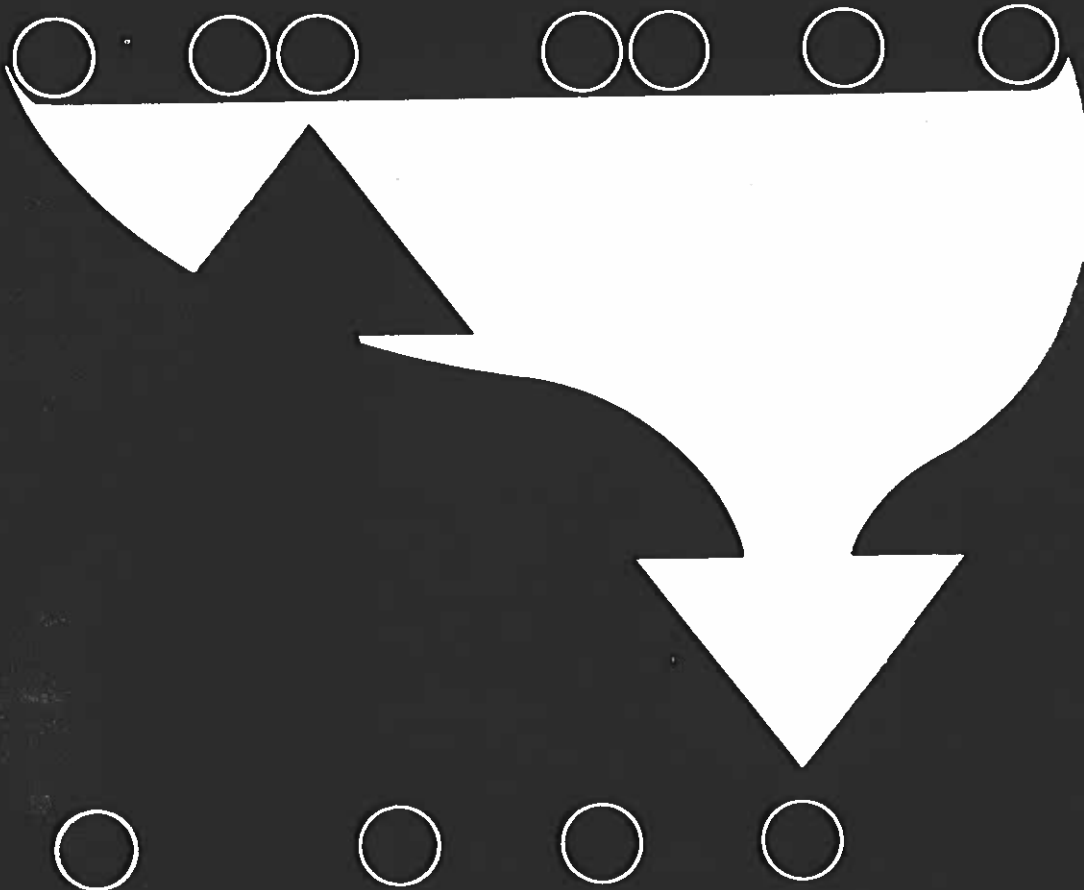
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