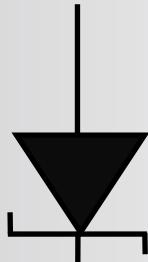


P.E.Ca.N.S

Pulse Emission Capacitive Neuronal Synapse



The Project

PECaNS is a project to investigate and examine the application of biological principles in the construction of more effective neural net infrastructure. By undertaking the project knowledge would be identified that would allow the construction of revised perceptron design that would offer lower power consumption and higher reliability in an analogue design rather than the current digital versions in use. A second feature of the project is that in creating the new net synapses, the knowledge of the design would throw new understanding on how the biological systems work.

As the title implies, the operating principle used is the use of electrical charge to store and transmit signals between perceptron/synapse components as part of a neural network. Emitted signals from the component would feed into one or more inputs on other identical components in either an effector or inhibitor capacity and like the biological equivalents, will not conduct a current through the network infrastructure. The only current flow being through the component to ground as part of its function. The result of this method of transmission is that the energy losses caused in digital circuits are minimised. With digital circuits, a large amount of energy is lost caused by the use of transistors to pass current to ground as part of the switching process. With the capacitive transfer method used in the project, switching is achieved by the use of a zener diode that passes the charge to the output once the breakdown voltage is reached. The charge transferred then passes to the input of the next synapse which in turn energises the capacitor and raises the voltage level on the receiving plate. To maintain equilibrium in the circuit, a drain resistor will slowly lower the charge level of the circuit to a preset level but the energy losses involved are far lower than its digital equivalent. The end result is that a large part of the energy used remains in circuit from start to end in the neural network.

Current design philosophy is based on the perceptron design developed by Frank Rosenblatt in 1959. The analog technology used is easily adapted for use in the mathematical functional requirements with the activation and summing functions being a matter of voltage and circuit capacity values that are simply adjusted using basic resistive components. This approach falls in line with observed biological characteristics where evolution has optimised energy consumption by using minimal energy for maximum effect. In this case conventional wisdom states that chemical neurotransmitters pass signals between neurons. This project asks 'Is capacitive charge balance used to transmit signals with neurotransmitters being the initiators instead?'

The investigation continues...