

Analog Vision Chips for Early Visual Processing

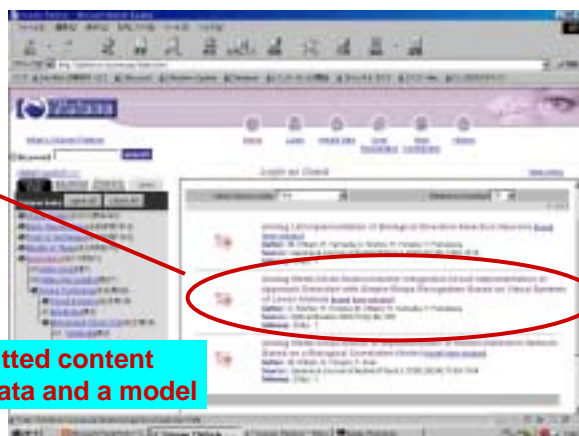
Hiroo YONEZU

Toyohashi University of Technology

Analog MOS integrated circuit implementation of approach detection with simple-shape recognition based on visual systems of lower animals

K. Nishio, H. Yonezu, M. Ohtani, H. Yamada, Y. Furukawa,
Optical Review, 10 (2003) 96-105

An analog network for detection of object approach with simple-shape recognition was proposed and designed based on the visual systems of lower animals. Simulation results with a simulation program with integrated circuit emphasis (SPICE) showed that the network can detect the approaching velocity and direction and that can also recognize simple shapes such as a circle, square and triangle.



Submitted content
with data and a model

Biological model

Model downloadable

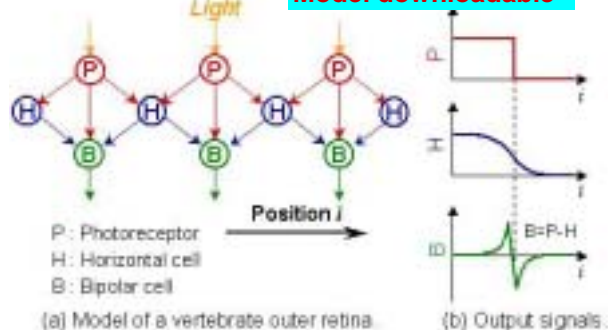


Fig.1 A model of an outer retina for edge detection. The absolute value of output signals from B at an edge position is larger than that at the other positions.

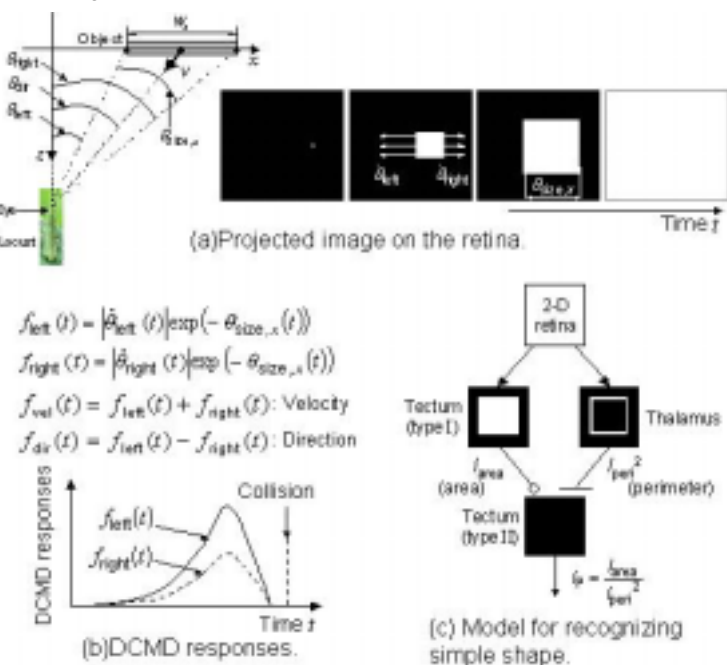


Fig.2 A model for approach detection with simple-shape recognition. The signal of the descending contralateral movement detector (DCMD) existing in locust brains, which inputs the signals of an image size and an expansion velocity (edge velocity), shows the peak value just before collision. The approaching velocity and the direction can be detected by using the peak signals. Model for recognizing simple shape was proposed based on frog visual systems.

Simulations

Circuits and data downloadable

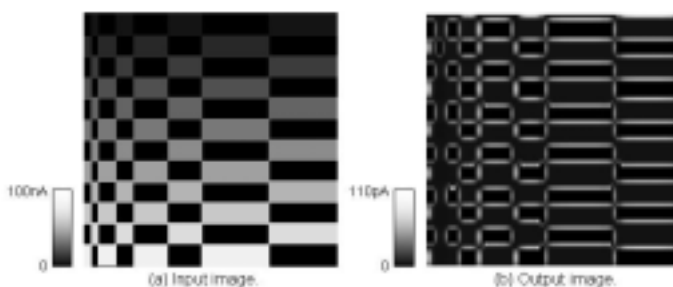


Fig.3 A simulation result of two-dimensional edge detection network (74 x 72) with SPICE.

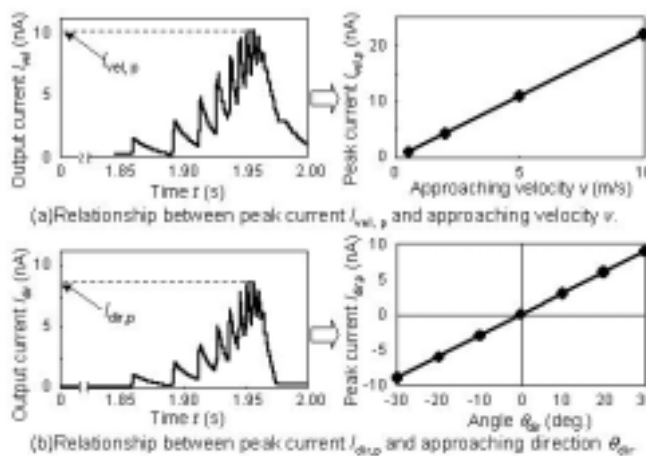


Fig.4 Simulation results of an approach detection network constructed with simple analog circuits. The approaching velocity and direction can be detected by using the peak current $I_{vel,p}$ and $I_{dir,p}$, respectively.

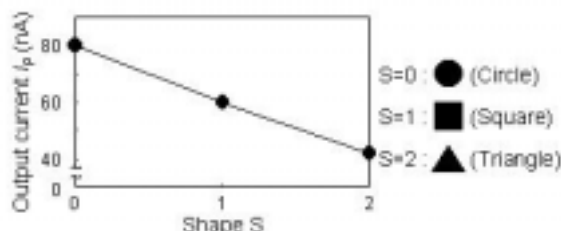


Fig.5 Simulation results of a network for recognizing simple shape. The network can recognize a simple shape such as a circle, square and triangle by using the output current I_p .