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Control of a Real Chaotic Cellular Neural Network

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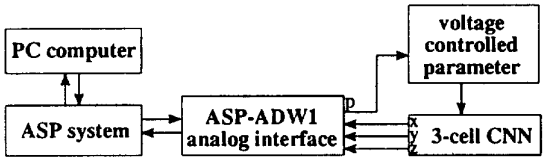
In this paper we study the possibilities of suppressing chaotic behaviour of the three-cell Cellular Neural Network. We present the laboratory environment and experimental results of stabilization of one of the existing unstable periodic orbits, by means of applying small periodic perturbations to one of the circuit parameters. The hardware setup is shown below.



For the experiments the three-cell CNN electronic circuit, with 10 ms time constant was built. We implemented the voltage controlled parameter by means of the MC1494 analog multiplier. For the acquisition of data and control we used the ASP system, equipped with 32-bit floating point NEC Advanced Signal Processor $\mu PD77230$. The ASP system was connected to the analog world through the ASP-ADW1 analog interface, supporting 4 input and 1 output channels. The sampling rate was 256 kHz and the resolution of the digitized values was 12 bits. The ASP system was also connected to a PC, which enabled programming the ASP processor and interchange of data.

The results obtained are promising. The data acquisition and identification part work correctly. Basing on time series obtained from the real process, we have found several unstable periodic orbits and their parameters necessary for the control. We have performed a number of control experiments. We have measured the performance of the system and noticed that the trajectory remains longer in the neighbourhood of the stabilized periodic orbit in the case when the control is active. We conclude that the control method is sensitive to noise and accuracy of the computed parameters of the stabilized periodic orbit. We believe that with some modifications a successful control is possible.

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