different high voltage pulses: 170 V at 93 Hz, and 460 V at 10 kHz. Cortical bone specimens were obtained from sheep femur and tibia diaphysis and divided into both control (without pulse power excitation) and experimental sample (exposed to pulse power) groups. Nondestructive three-point bending test was conducted to evaluate the mechanical properties of bone samples. Elastic modulus and bone extrinsic stiffness were determined before and after pulse power excitation under the above-mentioned voltage and frequency conditions for 8 and 5 days, respectively. Comparison of either extrinsic stiffness or young's modulus showed the fluctuations up to 10% in both control and experiment group. We conclude that pulse power applied to the extent of the parameters used in this study does not produce a significant change in the biomechanical characteristic of bone. This could be a consequence of bone size or other matters relating to the applied conditions, leading to more ongoing research to resolve these issues.

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A new perspective on ultrasound assessment of cancellous bone

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Objective The measurement of broadband ultrasonic attenuation (BUA) at the calcaneus for osteoporosis assessment was first described in 1984 although there still lacks an understanding of its dependence upon the density and structure of cancellous bone. It has recently been proposed that the primary attenuation mechanism is phase interference due to variations in transit time as detected over the phase-sensitive surface of the receive ultrasound transducer [1]. This has subsequently led to the development of Ultrasound Transit Time Spectral Analysis (UTTSA), with the potential to quantify the bone volume fraction.
Methods A transmission ultrasonic signal was recorded in each of the three orthogonal directions in magnified stereolithography replicas of four cancellous bone samples that had previously been microCT scanned. The experimental system consisted of two coaxially aligned 1 MHz broadband ultrasound transducers; the transmitting transducer energized by a 400 V spike, the receive transducer connected to a 14-bit, 20 MHz digitiser card. Through deconvolution of the input and output ultrasound signals, transit time spectra were derived from which the bone volume fraction was estimated.
Results A coefficient of determination of 96.7% was achieved between the known bone volume fraction derived from the microCT scans and the UTTSA estimated value.
Conclusion An experimental study has successfully demonstrated that ultrasound transit time spectral analysis provides a reliable estimate of bone volume fraction in stereolithography replicas of cancellous bone.
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Physical Implementation of Pair-Based Spike-Timing-Dependent Plasticity

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Objective Spike-timing-dependent plasticity (STDP) is one of several plasticity rules which leads to learning and memory in the brain. STDP induces synaptic weight changes based on the timing of the pre- and post-synaptic neurons. A neural network which can mimic the adaptive capability of biological brains in the temporal domain, requires the weight of single connections to be altered by spike timing. To physically realise this network into silicon, a large number of interconnected STDP circuits on the same substrate is required. This imposes two significant limitations in terms of power and area. To cover these limitations, very large scale integrated circuit (VLSI) technology provides attractive features in terms of low power and small area requirements. An example is demonstrated by (Indiveri et al. 2006). The objective of this paper is to present a new implementation of the STDP circuit which demonstrates better power and area in comparison to previous implementations.
Methods The proposed circuit uses complementary metal oxide semiconductor (CMOS) technology as depicted in Fig. 1. The synaptic weight can be stored on a capacitor and charging/discharging current can lead to potentiation and depression.
Results and Conclusion HSpice simulation results demonstrate that the average power, peak power, and area of the proposed circuit have been reduced by 6, 8 and 15%, respectively, in comparison with Indiveri's implementation. These improvements naturally lead to packing more STDP circuits onto the same substrate, when compared to previous proposals. Hence, this new implementation is quite interesting for real-world large neural networks.

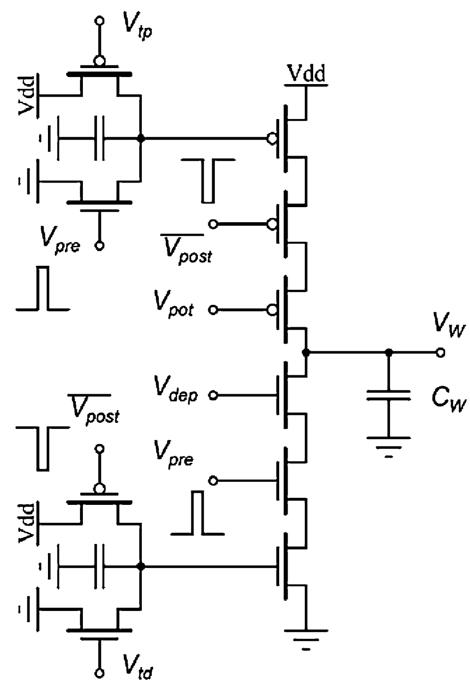

Fig. 1 CMOS VLSI implementation of pair-based STDP. V_{pre} and $\overline{V_{post}}$ are pre- and reversed postsynaptic pulses coming from neurons, V_{dep} and V_{pot} limit the amount of potentiation or depression, and finally V_{tp} and V_{td} alongside with their corresponding capacitors control the required time constants of the STDP. The synaptic weight is stored on C_w capacitor

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