in an ultrasound image and clearly distinguish them from surrounding bright echoes.

II. Theory

A. Particle Motion in a Magnetic Field

An elongated, magnetizable particle (one that is acted upon by a magnetic field, but carries no significant permanent magnetic field of its own) in a magnetic field experiences a torque that tends to align it with the field [7]. This is observed, for instance, when iron filings are scattered on a paper placed atop a magnet; the filings align themselves with the field. The alignment occurs even though the particles themselves are not magnetized, so long as the particle has a discernable anisotropy.

A periodic force applied to particles embedded in an elastic medium will cause them to vibrate about their rest positions. This periodic force may be applied to the particles by an oscillating magnetic field, generated, for instance, by an alternating current in a coil of wire. The field strength is proportional to the current flowing in the coil, and the torque on the particle is proportional to the square of the applied field [7], [8]. Because of the square law dependence of torque on current, the vibration of the particle is twice the frequency of the coil current. The particle receives a torque in the same direction for each half cycle of the current.

A permanently magnetized particle will experience a torque whose direction will depend upon the direction pf the field; reversing the field will reverse the torque. The torque will be proportional to the applied field, and the vibration frequency is equal to the current frequency [7].

B. Doppler Detection

Doppler ultrasound is routinely used to detect and quantify the motion of blood and other tissues [9]. Vibrating objects are not ordinarily the targets of Doppler scans, but small vibrations are easily detectible with Doppler equipment [10], [11]. Vibrations with a frequency of more than a few Hertz produce Doppler signals with unique characteristics, most clearly seen in the pulsed wave (PW) Doppler spectrograph display [9], where vibrating targets result in bands in the spectrograph display at integer multiples of the vibration frequency [11]. Increased vibration amplitude shifts the bands to higher multiples of the vibration frequency. Vibration-induced Doppler signals are readily distinguished from flow-induced signals; their spectral content is symmetric about zero frequency, and the energy is confined to multiples of the vibration frequency.

C. Target Identification

Brachytherapy seeds may be made to vibrate within the prostate under the influence of an external magnetic field by replacing the radio-opaque marker in the seed with iron, a rare-earth magnet, or other suitable magnetic component. Because the proposed modification replaces one radio-opaque material with another, we do not expect our modification to significantly change the appearance of seeds under X-ray or CT. No external modification to the seed is required, though it is certainly possible to place the ferromagnetic component on the outside of the seed. The vibration may be identified with the Power Doppler mode of an ultrasound scanner, which will highlight in color all vibrating withviy5e3acinD-566dchthether3i03(ssplay)-24tsi

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Two Multichannel Integrated Circuits for Neural Recording and Signal Processing

Iyad Obeid*, James C. Morizio, Karen A. Moxon, Miguel A. L. Nicolelis, and Patrick D. Wolf

Abstract—We have developed, manufactured, and tested two analog CMOS integrated circuit "neurochips" for recording from arrays of densely packed neural electrodes. Device A is a 16-channel buffer consisting of parallel noninverting amplifiers with a gain of 2 V/V. Device B is a 16-channel two-stage analog signal processor with differential