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The Suppression of Dominant Acoustic Frequencies in MRI[1]
XINGXIAN SHOU, ROBERT BROWN, Case Western Reserve University — Patient discomfort and brain imaging distortion are serious MRI acoustic noise problems arising from the rapid switching on and off of gradient coils in the presence of the strong Larmor magnetic field. A study is made of dominant frequencies in the acoustic noise spectrum and, motivated by both spring and string ideas, we propose the cancellation of selected frequencies by appropriate gradient pulse sequence design. From both simulations and experiments, vibrations resulting from an impulsive force associated with a ramping up of a gradient pulse are shown to be cancelled upon the application of another impulsive force coming from the appropriately timed ramping down of that pulse. A method for the suppression of multiple-frequency contributions involving a series of gradient pulses with variable timings is developed and confirmed by experiment. Whether we refer to reduction in terms of dB (about 30-40 dB per peak), or to the verdict of a listener, the conclusion is that a marked reduction in sound can be achieved when at least three of the dominant frequency peaks are suppressed. A variety of pulse profiles and timing combinations can be used to attenuate important contributions to the acoustic spectrum.

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