**An approximate on-axis impulse response for a circular piston in power law media**

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**ABSTRACT:** The power law wave equation is a wave equation with fractional time derivatives that models the frequency dependence of attenuation and speed of sound for ultrasound propagation in biological tissues.  To model frequency dependent attenuation and speed of sound in addition to the diffraction of ultrasound generated by a finite circular aperture, the Green’s function of the power law wave equation is integrated over the face of this aperture to obtain the lossy impulse response for a circular piston.  The impulse response is computed on-axis with the Rayleigh-Sommerfeld integral to establish a baseline for numerical calculations, and the results are compared to a newly derived approximate expression that converges much more rapidly than the Rayleigh-Sommerfeld integral.  The approximation for the lossy impulse response in effect inserts a loss term into a diffraction calculation performed with the fast nearfield method, which has advantageous numerical properties in simulations of diffracted pressure fields generated by finite apertures.