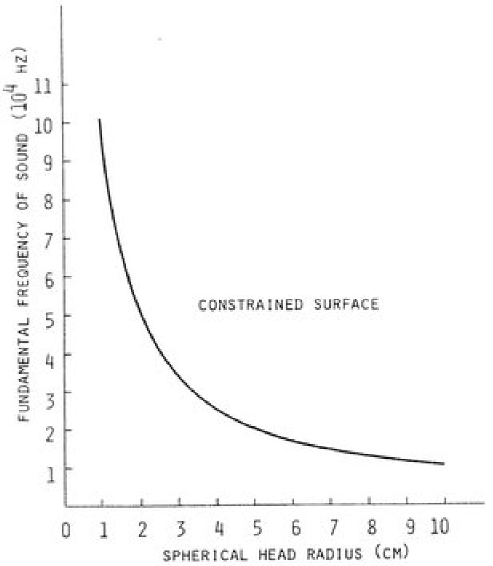

Fig. 2. Computed fundamental frequency of sound generated in a spherical head model irradiated with pulsed microwave energy.

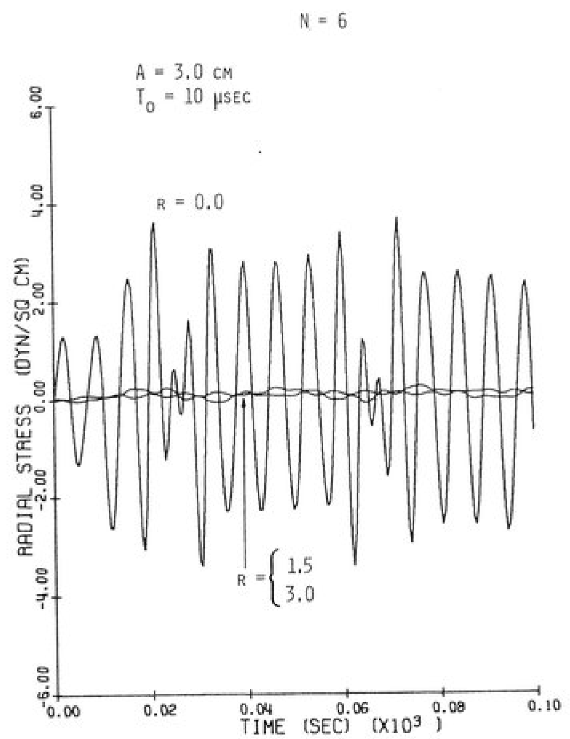

Fig. 3. Acoustic pressure (radial stress) generated in a 3-cm-radius (cat-sized) spherical head irradiated with 2450-MHz radiation. The incident peak power density is 589 mW/cm^2 and the peak absorbed energy is 1000 mW/cm^3.

known facts of auditory physiology nor is it in conflict with the observations that a necessary condition for auditory perception of microwaves is the ability to perceive auditory signals above 5 or 8 kHz [1], [5].

It should be noted that the frequencies predicted by this paper are about 70 percent higher than those calculated earlier based on stress-free boundary conditions [13]. Since the head is neither entirely stress free nor is it rigidly constrained, it is possible that the actual fundamental sound frequency falls somewhere between that predicted by these two approaches.

Radial Stress (Pressure) and Displacement

Fig. 3 is a plot of pressure σ in a 3-cm-radius spherical head irradiated with 2450-MHz radiation as a function of time for a 10-μs pulse. The curves are evaluated at $r = 0, 1.5$, and 3.0 cm. It is seen that the pressure is the highest in the center of the spherical head. After a transient buildup, which lasts for the duration of the pulsewidth, the pressure oscillates at a constant level because of the lossless assumption for the elastic medium. It is also important to note that the high-frequency oscillation is modulated by a low-frequency envelope whose frequency is the same as the fundamental frequency of sound given in Fig. 2 for a spherical head with $a = 3$ cm. The peak pressure generated at the center of the spherical head is 3.69 dyn/cm^2 for a peak absorption of 1000 mW/cm^3, which corresponds to 589 mW/cm^2 of incident power [19].

There are two sets of experimental data that are particularly suitable for comparison with the results described above. In one case the threshold incident power density was reported to be 2200 mW/cm^2 [3], [4]. For the other, the threshold was said to be about 1300 mW/cm^2 [5]. The corresponding peak pressure amplitude is therefore between 8.14 and 13.8 dyn/cm^2; i.e., 92–97 dB relative to 0.0002 dyn/cm^2. Assuming that perception by bone conduction for cats is the same as for humans, the minimum audible sound

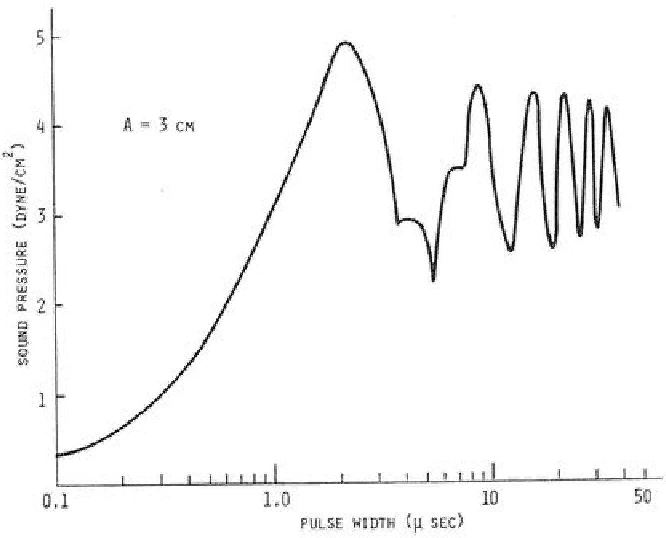

Fig. 4. Peak pressure generated in a 3-cm-radius spherical head irradiated with 2450-MHz radiation as a function of the incident pulsewidth. See Fig. 3 for other parameters.

pressure at 40 kHz is about 120 dB according to [25]. Thus the theoretically predicted threshold incident power density is close to the measured value.

The computed peak pressure as a function of pulsewidth is shown in Fig. 4 for a 3-cm-radius sphere exposed to 2450-MHz radiation. The curve is evaluated at a peak absorbed microwave energy of 1000 mW/cm^3. We see that an optimum pulsewidth for pressure generation occurs around 2 μs. This is similar to the free-surface formulation.

The displacement in the spherical model of the cat's head