

Ultrasonics 2017

Demo exercise 3

Deadline 23.4. 23:59.

Cavitation

- 1) Explain inertial (transient) and non-inertial (stable) cavitation.
- 2) Calculate the duty cycle of the following ultrasonic pulse: Center frequency of transducer $f=2\text{MHz}$, 40 cycles, pulse repetition frequency PRF=1 kHz.
- 3) Calculate the resonance bubble size of air bubbles in water using Minnaert's formula for the driving frequency $f=2.5\text{ MHz}$.

(M. Minnaert, "XVI. On musical air-bubbles and the sounds of running water," *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science*, vol. 16, no. 104, pp. 235-248, 1933. or find some other (simpler) source).

Power-chain of high-power US device

Explain how electrical power is transferred and converted from the amplifier to a cleaning effect. The device works by generating cavitation into containers from the outside (through the walls). The amplifiers used are general audio amplifiers. What kind of electronics are needed? How do the transducers work? Where do the power losses occur and how big are they? What environmental effects affect the cavitation threshold? How could one improve the current device to gain more cleaning effect?

General info will be given at the demo. Make the necessary assumptions.

Max 1 page.