

Physics of Ultrasound

Fifth lecture

Intensity of Ultrasound

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Third Stage

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2022- 2023

1. Introduction

To understand the meaning of intensity, we recall that an oscillating source of ultrasound in contact with tissue transfers its mechanical energy to the particles of the tissue medium, causing them to vibrate. The medium particles then possess energy by virtue of their motion.

- ✚ Intensity is a measure of this energy. It represents the vigor of mechanical vibrations of the medium particles.
- ✚ Different physical parameters may be used to express this vigor. These include particle displacement, particle velocity, particle acceleration, and particle pressure.
- ✚ Each of these parameters varies in time and in space within the medium, and so does the intensity.
- ✚ Intensity may be expressed either as an absolute measurement, or using a relative scale.

2. Absolute measure of intensity

- ✚ On the absolute scale, intensity is expressed as the rate of flow or energy per unit area.
- ✚ Definition: The intensity of a beam of ultrasound at a point is the amount of energy passing through unit cross-sectional area perpendicularly to the beam per unit time at that point
- ✚ Units: The following units are commonly used to specify absolute intensities in clinical ultrasound.

Joule (J) for energy

Seconds (s) for time

Square centimeter (cm²) for area.

Using these units, *intensity* is expressed in *joules/second/square centimeter*.