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Longitudinal wave: how do the particles move?

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Shear wave: how do the particles move, and where can it not travel?

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Surface (Rayleigh) wave: motion, depth and speed?

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Worked (invented numbers): a 5 MHz shear wave in steel at 3.24 mm/µs. Wavelength?

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Acoustic impedance is the product of which two things?

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At a boundary met square on, what decides how much sound reflects?

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Side to side, across the direction of travel. It needs a solid, so it does not pass through liquids or air.

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Back and forth along the direction of travel. It travels in solids, liquids and gases.

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Wavelength = velocity / frequency = 3.24 / 5 = 0.65 mm.

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Elliptical motion within about one wavelength of the surface, a little slower than shear. Used for surface-breaking cracks.

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How different the two impedances are. Very different: nearly all reflects. Similar: most passes through.

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Density and sound velocity.

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Snell's law for ultrasound?

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First and second critical angles: what does each remove?

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Worked (invented numbers): wedge 2.73 mm/µs, steel shear 3.24 mm/µs, wanted shear angle 45 degrees. Incident angle?

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Near-field length of a circular probe, and what changes it?

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What makes beam spread wider?

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Attenuation: two causes, and how frequency affects it?

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At the first, the refracted longitudinal wave reaches 90 degrees. At the second, the shear wave does. Between them only shear enters: the working range for angle-beam probes.

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sin(angle 1) / velocity 1 = sin(angle 2) / velocity 2, with both angles measured from the normal.

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N = D squared x f / (4 x v). Doubling the diameter multiplies N by four; doubling the frequency doubles it.

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sin(i) = (2.73 / 3.24) x sin 45 = 0.843 x 0.707 = 0.596, so about 36.6 degrees.

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Scattering at grain boundaries and absorption into heat. It climbs steeply with frequency, so coarse grain needs a lower frequency.

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A lower frequency or a smaller element. A higher frequency or larger element narrows it.

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