Radiology Techniques Department, College of Medical Technology, The Islamic University, Najaf, Iraq

Theoretical Radiation Physics

Third stage-Department of Radiological Technique

Lecture 3part 2

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Radiation Physics precise specialization

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the wave phase:

The word phase refers to every stage that changes from certain properties to other properties, since longitudinal waves are series of alternating compressions and rarefactions in the material medium, and the pressure , density and displacement of the molecules of the medium are in a state of change when we move from the compression region to the rarefaction region , also a change in pressure ,density and displacement occurs when we move from the rarefaction region to the compression region, so we can call to the compression region the compression phase ,and to the rarefaction region the rarefaction phase, and since the molecules at a particular point of the medium have pressure, density, and displacement that differ from what it is in molecules at the neighboring points, that is the pressure, density and displacement are in a state of change from one point to another due to wave motion , so it can be said that each

point of the medium has a specific wave phase, that is the molecules at that point have certain properties of pressure ,density and displacement at a moment in time , and these properties are in a state of change towards increase or decrease according to disturbance if it is compression or rarefaction .
The wave length can be calculated from the distance between any two similar points in phase from any two adjacent wave cycles.

The graphical representation of the change in pressure, density and displacement.

If we take one wave cycle consisting of two phases ,one of them is compression and the other is rarefaction ,the distance at which the two phases appear is equal to the wave length (λ).we consider the boundary between the phases of compression and rarefaction as a starting point towards an increase in pressure as in point (0) or a starting point towards a decrease in pressure as in point (8), so that points (0) and (8) are the equilibrium points for the fluid medium , then the pressure increases at points (1,2,3) until the pressure reaches the highest value and that's at point (4) , which is at the center of the compression phase , since we call the pressure at this point the The peak of the posetive pressure , and at points (5,6,7) , the pressure decreases to approach the equilibrium point (8) , then the pressure takes a decrease to less than the equilibrium point to begin the rarefaction phase this is at the points (9,10,11) until the pressure reaches its lowest value at point (12), and where we call the pressure at this point the The peak of the negative pressure,then the pressure increases at points (13,14,15) to approach the equilibrium point (16) at the boundary of the adjacent wave cycle ,as shown in figure (1) , these points can be represented graphically through the (x) and (y) axes , where the x-axis represents the distance in which the disturbance appears ,and

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through this axis we determine the distance of each point from the equilibrium point (0), while the y-axis represents the value of the pressure at each point , and thus we get figure (2) ,and when these points are connected we get figure (3) , which is a curve similar to the shape of the sinusoidal function and also similar to the shape of the cord wave.
Likewise for the density of the molecules ,it increases at points (1,2,3) in the compression phase ,and the greatest value of the density at the point (4), where this point represents he peak of the positive density and then decreases at points (5,6,7) to return to the equilibrium point (8) , then the density decreases to less than the equilibrium point to begin the phase of the rarefaction at points (9,10,11) until it reaches the lowest value of the density at point(12) , where this point represent The peak of the negative density , then the density

Takes an increase at points (13,14,15) until it returns to the equilibrium point is (16),

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when we represent these points graphically ,we get a curve similar to the pressure curve , as shown in fig (4) .since the molecules of the fluid medium are affected by the movement of the source of the disturbance (piston) left and right generating the phases of compression and rarefaction, when the piston moves to the right , the molecules of the medium are dis placed from their places of stability by a certain displacement to the right, where the displacement is taken incrementally at points (1,2,3) and its maximum value is at point (4) ,where the displacement at this point is called the peak of the positive displacement , and sometimes the displacement from the stable position is called the amplitude and the peak of the displacement is called the peak of the positive amplitude , then this displacement decreases until it reaches the equilibrium point (8), and when the piston is pulled to the left , the molecules of the medium begin to move away from the position of stability but towards the left, and that this displacement in the opposite direction increases at points (9,10,11) until the maximum displacement or maximum amplitude in the opposite direction reach at point(12), so it is called the peak of negative displacement or amplitude ,then the displacement is taken back at points (13, 14,15) until it reaches the equilibrium point (16) to start another wave cycle , and where we get a curve similar to the pressure curve or the density curve as in figure (5).