WAVE REFLECTION FROM MULTIPLE INTERFACES →

We consider wave reflection from materials that are finite in extent, i.e we must consider the effect of the front and back surfaces. In such problems two-interface problem.

In fig. which a uniform plane wave propagating in the forward z direction is normally incident from the left onto the interface between regions 1 & 2, there have intrinsic impedences, η_1 & η_2. A third region of impedence η_3 lies beyond region 2, and so a second interface exists between regions 2 & 3. We let the second interface location occur at $z=0$, & so all positions to the left will be described by values of z that are negative. The width of the second region is l, so the first interface will occur at position $z=-l$.

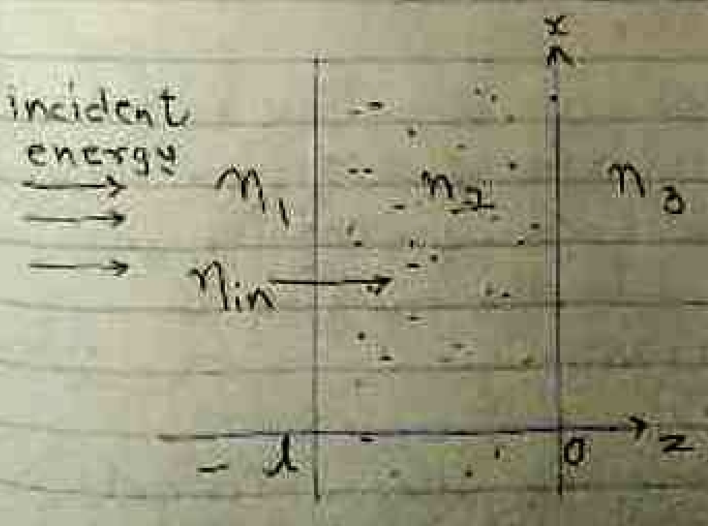

Fig: Two-interface problem.

When the incident wave reaches the first interface, events occur as follows: A portion of the wave reflects, while the remainder is transmitted, to propagate toward the second interface. There a portion is transmitted into region 3, while the rest reflects and returns to the first interface; there it is again partially reflected. This reflected wave then combines with additional transmitted energy from region 1, and the process repeats. We thus have a complicated sequence of multiple reflections that occurs within region 2, with partial transmission at each bounce, boun bounce.

Region 2, with partial transmission at each bounce can be solve by transient phase.

If the incident wave is left on for all time, however a steady-state situation is eventually reached,

1. An overall fraction of the incident wave is reflected from the two-interface configuration and back-propagates in region 1 with a ~~defenite~~ definite amplitude and phase.

2. An overall fraction of the incident wave is transmitted through the two interfaces & forward-propagates

in the third region.

3. A net backward wave exists in region 2, consisting of all reflected waves from the second interface.
4. A net forward wave exists in region 2, which is the superposition of the transmitted wave through the first interface, & all waves in region 2 that have reflected from the first interface & are now forward-propagating.

The effect of combining many co-propagating waves in this way is to establish a single wave which has a difunte defun definite amplitude & phase, determined through the sums of the amplitudes & phases of all the component waves.

In steady state, we thus have total of five waves to consider. These are the incident & net reflected waves in region 1, the net transmitted wave in region 3, & the two counter-propagating waves in region 2.