BEWLEY LATTICE DIAGRAM

This is a convenient diagram devised by Bewley, which shows at a glance the position and direction of motion of every incident, reflected, and transmitted wave on the system at every instant of time. The diagram overcomes the difficulty of otherwise keeping track of the multiplicity of successive reflections at the various junctions.

Consider a transmission line having a resistance **r**, an inductance **l**, a conductance **g** and a capacitance **c**, all per unit length.

If _ is the propagation constant of the transmission line, and **E** is the magnitude of the voltage surge at the sending end, then the magnitude and phase of the wave as it reaches any section distance **x** from the sending end is **Ex** given by.

$$E = E .e = E .e = E\, e\, e - x - (+ j) x - x - j\, xx\, \gamma\, \alpha\, \beta\, \alpha\, \beta$$

Where,

e - represents the attenuation in the length of line x

$\mathbf{e}^{-j}$ - represents the phase angle change in the length of line x

Therefore,

- Attenuation constant of the line in neper/km
- Phase angle constant of the line in rad/km.

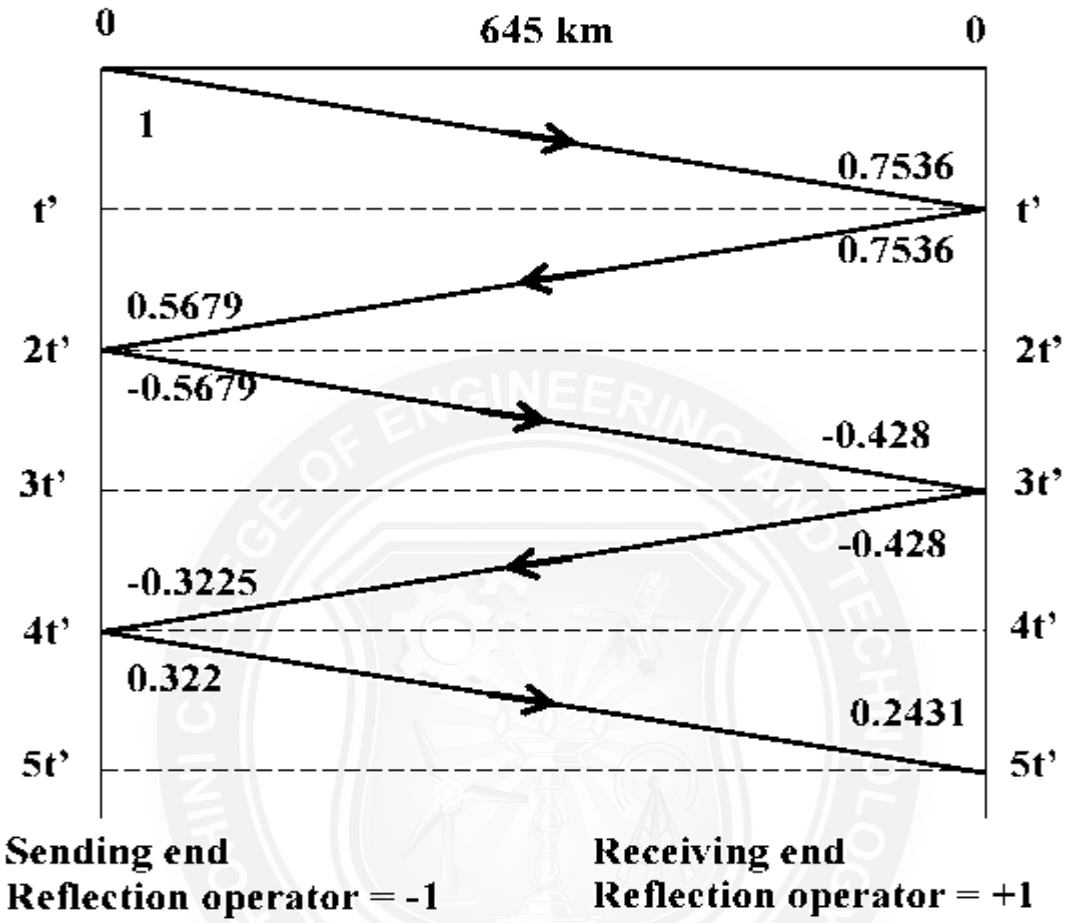

Figure 1.1 Bewley Lattice Diagram

[Source: "High Voltage Engineering" by C.L. Wadhwa , Page – 76]

It is also common for an attenuation factor k to be defined corresponding to the length of a particular line. i.e.

k = e for a line of length l.

When a voltage surge of magnitude unity reaches a junction between two sections with surge impedances Z_1 and Z_2, then a part is transmitted and a part is reflected back. In traversing the second line, if the attenuation factor is k, then on reaching the termination at the end of the second line its amplitude would be reduced. The lattice diagram may now be constructed as follows. Set the ends of the lines at intervals equal to the time of transit of each line. If a suitable time scale is chosen, then the diagonals on the diagram show the

passage of the waves.

In the Bewley lattice diagram, the following properties exist.

- All waves travel downhill, because time always increases.
- The position of any wave at any time can be deduced directly from the diagram.
- The total potential at any point, at any instant of time is the superposition of all the waves which have arrived at that point up until that instant of time, displaced in position from each other by intervals equal to the difference in their time of arrival.
- The history of the wave is easily traced. It is possible to find where it came from and just what other waves went into its composition.
- Attenuation is included, so that the wave arriving at the far end of a line corresponds to the value entering multiplied by the attenuation factor of the line.