Computer Spreadsheet Assignment 2

Computer Simulation of Splitting of Light Beam as a Function of Glass Types and Thickness, and Angle of Incidence

Computer simulation/modeling is a very useful tool in engineering analyses and design, because it can help engineers narrow down the design parameters and save them valuable resources in testing.

You have just observed the phenomenon of front and back reflection of an incident laser beam. In order to distinguish the front- and back-reflected beam, the distance separating the two beams must be larger than the size of the beam. If the distance is smaller than the beam size (3 mm), the two beams overlap and you cannot distinguish the front- and back-reflected beams.

You have also observed the derivation of the formula to calculate the distance between the front- and back-reflected beams. From the formula, this distance depends on the glass thickness and types of glass (given by its Refractive Index), and the angle of incidence.

Use EXCEL to calculate the beam separation distance as a function of:
1) Glass thickness from 1/8 inch to ½ inch glass in increments of 1/8-inch
2) Angle of incidence from 0° to 85° in increments of 5°
3) Glass types as characterized by the Refractive Index (RI). Select any two glass types from the following list for your spreadsheet program
   - Commercial Glass, RI = 1.46
   - Quartz Glass RI = 1.50
   - Leaded Glass RI = 2.50
   - Soda-Lime Glass RI = 2.65

On the spreadsheet, calculate the beam separation distance as a function of the variables and graph the results of beam separation distance as a function of angle of incidence for a specific type of glass and for thickness ranging from 1/8 inch to ½ inch.

In a memorandum to Dr. Tsang, report the angle of incidence and the glass type and glass thickness you would recommendation for such a demonstration. Attach the Excel worksheet and graph to the memorandum. Assignment 10 is due on xx.

Some mathematical functions and the corresponding EXCEL codes relevant to this assignment are:

<table>
<thead>
<tr>
<th>Math Function</th>
<th>EXCEL Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>π</td>
<td>Pi( )</td>
</tr>
<tr>
<td>Sine</td>
<td>sin( )</td>
</tr>
<tr>
<td>Cosine</td>
<td>cos( )</td>
</tr>
<tr>
<td>Tangent</td>
<td>tan( )</td>
</tr>
<tr>
<td>Inverse Sine</td>
<td>asin( )</td>
</tr>
</tbody>
</table>

To convert an angle from degrees to radian:
Angle in radian = (Angle in degree) x π/180