**Snell's Law** $n \sin\theta = n' \sin\theta'$

Approx. $n\theta = n'\theta'$

$n = 1 \qquad n' = 1.5$

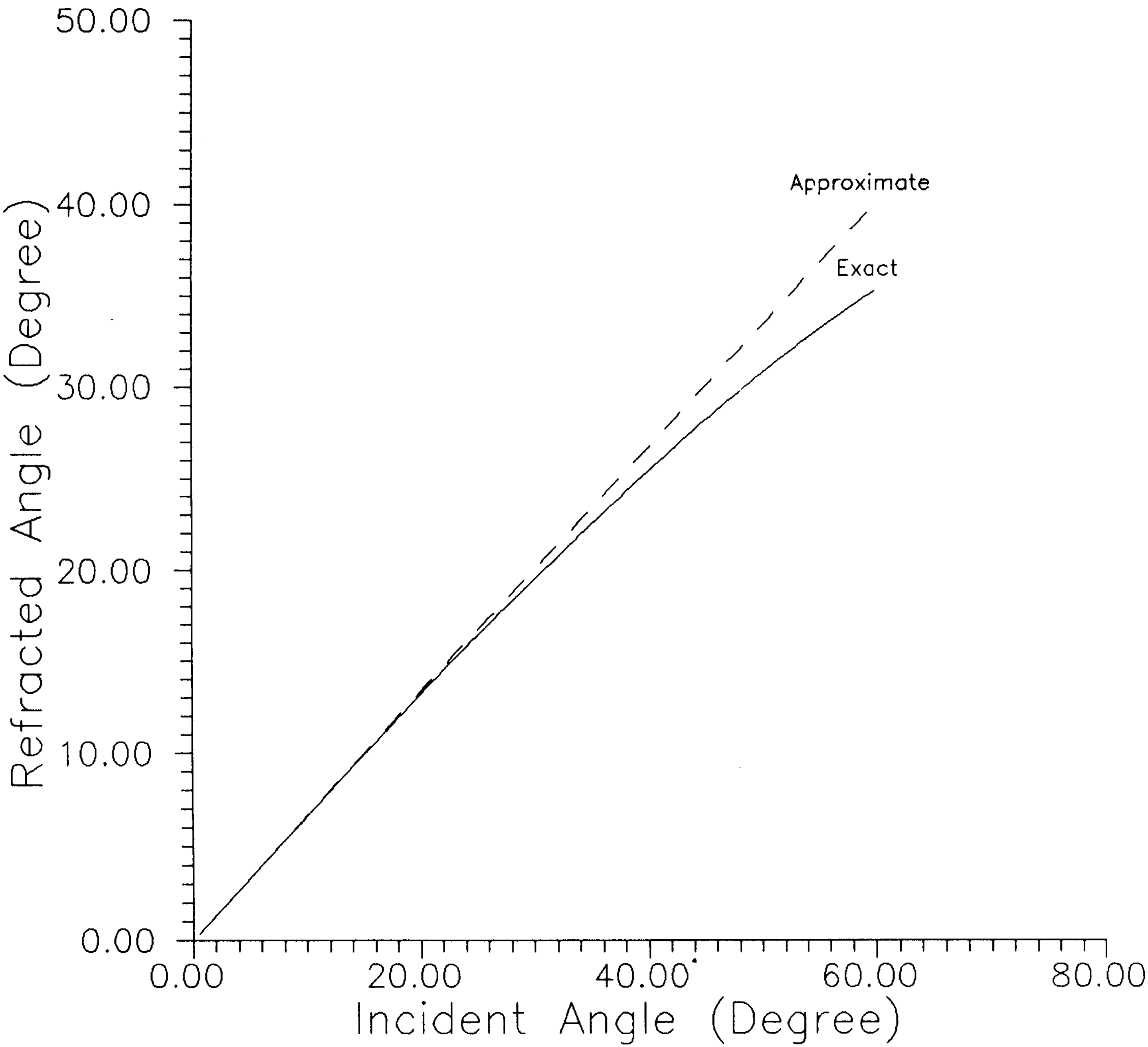
$$\theta' = \sin^{-1}\left(\frac{1}{n'} \sin\theta\right)$$

$$\theta' \approx \frac{\theta}{n'}$$

In Degrees:

| $\theta$ | $\theta'$ | $\sim\theta'$ | $(\sim\theta' - \theta')/\theta'$ | |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | |
| 5 | 3.331 | 3.333 | $7 \times 10^{-4}$ | |
| | | | | ← .1% |
| 10 | 6.648 | 6.667 | .0028 | |
| 15 | 9.936 | 10 | .0065 | |
| | | | | ← 1% |
| 20 | 13.180 | 13.333 | .012 | |
| 25 | 16.364 | 16.667 | .018 | |
| 30 | 19.471 | 20 | .027 | |
| 35 | 22.481 | 23.333 | .038 | |
| 40 | 25.374 | 26.667 | .051 | |
| 45 | 28.126 | 30 | .067 | |
| 50 | 30.710 | 33.333 | .085 | |
| | | | | ← 10% |
| 55 | 33.100 | 36.667 | .108 | |
| 60 | 35.264 | 40 | .134 | |
| 65 | 37.172 | 43.333 | .166 | |

Plotted on next page.


50.00
40.00
30.00
20.00
10.00
0.00
Refracted Angle (Degree)
0.00
20.00
40.00
60.00
80.00
Incident Angle (Degree)
Approximate
Exact

Continued ....

% Error

$$\frac{\sim\theta' - \theta'}{\theta'} = E$$

$$\sim\theta' - \theta' = E\theta'$$

$$\sim\theta' = (1+E)\,\theta'$$

$$\frac{\theta}{n'} = (1+E)\,\sin^{-1}\left(\frac{1}{n'}\sin\theta\right)$$

$$\sin\left(\frac{\theta}{n'(1+E)}\right) = \frac{1}{n'}\sin\theta$$

This can be solved by numerical methods for the value of $\theta$ at different levels of E.

We can get approximate values by interpolation of the tabulated values

$E = .001$ (.1%) $\theta = 5.7°$

$E = .01$ (1%) $\theta = 18.2°$

$E = .10$ (10%) $\theta = 53.3°$