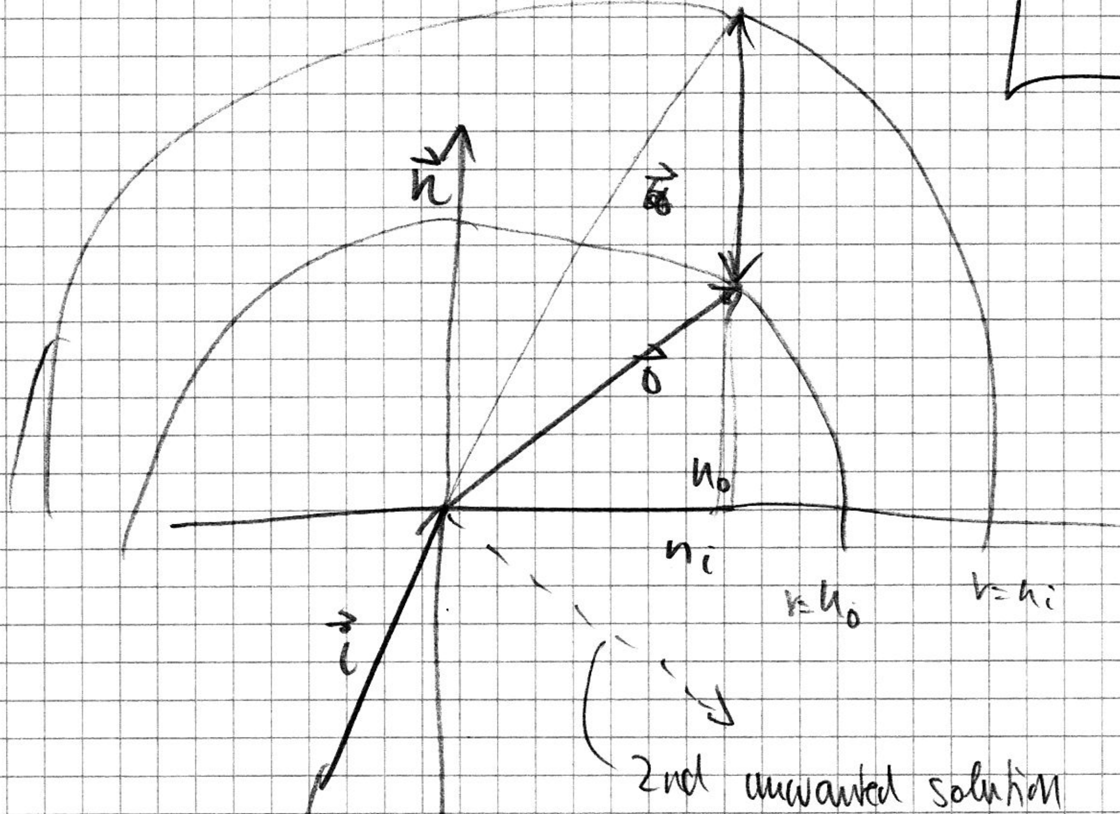
Vectorial Snell
23.8.2020



$$\boxed{\begin{aligned} \vec{o} &= \vec{i} - \lambda \cdot \vec{n} \\ D &= n_o^2 - n_i^2 + (\vec{n}\cdot\vec{i})^2 \\ \lambda &= -\sqrt{D} + \vec{n}\vec{i} \end{aligned}}$$

Tests: $\vec{o} \parallel \vec{i} \parallel \vec{n}$:

$\vec{n}\,\vec{i} = n_i$

$D = n_o^2 - n_i^2 + n_i^2 = n_o^2$

$\lambda = -n_o + n_i$

$\vec{o} = \vec{i} + (n_o - n_i)\vec{n}$

$= \vec{i} + n_o\vec{n} - n_i n$

$= n_o\vec{n}$

$$\vec{o} = \vec{i} - \lambda \cdot \vec{n} \qquad (1)$$

$\vec{o}\cdot\vec{o} = n_o^2$

$\vec{i}\cdot\vec{i} = n_i^2$

$\vec{n}\cdot\vec{n} = 1$

$\vec{o}\cdot\vec{o} = (\vec{i} - \lambda\vec{n})\cdot(\vec{i} - \lambda\vec{n})$ (1 squared)

$= \vec{i}\cdot\vec{i} - 2\lambda\,\vec{n}\,\vec{i} + \lambda^2\,\vec{n}\cdot\vec{n}$

$n_o^2 = n_i^2 - 2\lambda\,\vec{n}\,\vec{i} + \lambda^2$

$\lambda^2 - 2\lambda\,\vec{n}\,\vec{i} + (\vec{n}\,\vec{i})^2 = n_o^2 - n_i^2 + (\vec{n}\cdot\vec{i})^2$

$(\lambda - \vec{n}\,\vec{i})^2 = \underbrace{n_o^2 - n_i^2 + (\vec{n}\cdot\vec{i})^2}_{D}$

$\lambda = (\pm)\sqrt{D} + \vec{n}\,\vec{i}$

$(+) \to$ unwanted