2. (a2) $s(k) = \frac{1-2i\lambda\sin\theta}{1+2i\lambda\sin\theta} = \frac{1-4\lambda^2\sin^2\theta}{1+4\lambda^2\sin^2\theta} - i\,\frac{4\lambda\sin\theta}{1+4\lambda^2\sin^2\theta}$

$(\theta = kh_x)$

Here $|s(k)| = 1$ so there is no dissipation. (Fig. 2-a2-1)

For $s(k) = e^{i\phi}$

so $\phi = i\ln\frac{1-2i\lambda\sin\theta}{1+2i\lambda\sin\theta} \Big/ (kh_t)$

On the other hand;

$s(k) = e^{i\phi} = \cos\phi + i\sin\phi$

so $\phi = -\arcsin\left(\frac{4\lambda\sin kh_x}{1+4\lambda^2\sin^2 kh_x}\right)$

so $V_{ph} = \frac{\arcsin\left[\frac{4\lambda\sin(kh_x)}{1+4\lambda^2\sin^2(kh_x)}\right]}{k\,h_t}$ $\qquad \lambda = \frac{ah_t}{h_x}$

For plot please see Fig 2-a2-2. 2-a2-3. 2-a2-4.

If we set $a=1$ (we can always re-sale x ~~t~~ to get that),

For small h_x, when $h_t \to 0$ $(\lambda \to 0)$ $V_{ph} \to 1$ Fig 2-a2-2

For small h_t, when $h_x \to 0$ $V_{ph} \to 1$ Fig 2-a2-3

For small λ, when $h_x \to 0$, $V_{ph} \to 1$ Fig 2-a2-4