$$\sigma_s^2 = \sum_{i=0}^{p} a_i r_{yy}[i] = a_0 r_0 + a_1 r_1 + a_2 r_2$$

$$= \sigma_w^2 + a_1\left(-\frac{a_1}{1+a_2}\right)\sigma_y^2 + a_2\left(\frac{a_1^2}{1+a_2} - a_2\right)\sigma_y^2$$

$$= \sigma_y^2\left(1 - \frac{a_1^2}{1+a_2} + \frac{a_1^2 a_2}{1+a_2} - a_2^2\right) = \sigma_s^2$$

$$\sigma_y^2 = \frac{\sigma_s^2}{1 - \frac{a_1^2}{1+a_2} + \frac{a_1^2 a_2}{1+a_2} - a_2^2} = \frac{1+a_2}{1+a_2} \frac{\sigma_s^2}{1+a_2 - a_1^2 + a_1^2 a_2 - a_2^2(1+a_2)}$$

$$= \frac{(1+a_2)\,\sigma_s^2}{1+a_2+a_1^2 a_2 - a_2^2 - a_2^3 - a_1^2} = \frac{}{1+a_2 - a_2^2 - a_2^3 - a_1^2(1-a_2)}$$

$$= \frac{(1+a_2)}{(1-a_2)(a_2-1)^2 - a_1^2(1-a_2)}$$

$$= \frac{1+a_2}{1-a_2} \frac{\sigma_s^2}{[(1+a_2)^2 - a_1^2}$$