

Target equation:

$$-ia_1u^{(1,0)}(x,t) + a_2u^{(2,0)}(x,t) - ia_3u^{(3,0)}(x,t) + a_4u^{(4,0)}(x,t) - bu(x,t)|u(x,t)|^2 + iu^{(0,1)}(x,t) = 0$$

Substitutions:

$$N = 2$$

$$u(x,t) \rightarrow y(z)e^{i(kx-\omega t)}$$

$$z \rightarrow x - C_0t$$

$$y(z) \rightarrow AR(z)^2$$

$$R'(z)^2 = R(z)^2(1 - \chi R(z)^2)$$

Imaginary part of equation after substitutions:

$$y'(z)(a_1 - 2a_2k - 3a_3k^2 + 4a_4k^3 - C_0) + y^{(3)}(z)(a_3 - 4a_4k) = 0$$

Real part of equation after substitutions:

$$y(z)(a_1k - a_2k^2 - a_3k^3 + a_4k^4 + \omega) + y''(z)(a_2 + 3k(a_3 - 2a_4k)) + a_4y^{(4)}(z) - by(z)^3 = 0$$

Constraints on coefficients from imaginary part of equation:

$$a_3 \rightarrow 4a_4k$$

$$C_0 \rightarrow a_1 - 2a_2k - 8a_4k^3$$

Constraints on coefficients from real part of equation:

$$b \rightarrow \frac{120a_4\chi^2}{A^2}$$

$$a_2 \rightarrow -2(3a_4k^2 + 10a_4)$$

$$\omega \rightarrow -a_1k - 3a_4k^4 - 20a_4k^2 + 64a_4$$

y(z) - function:

$$\frac{16a^2A}{(4a^2e^z + \chi e^{-z})^2}$$

u(x, t) - function:

$$\frac{16a^2Ae^{i(kx-\omega t)}}{(4a^2e^{C_0t+x} + \chi e^{-C_0t-x})^2}$$