

Target equation:

$$-ia1u^{(1,0)}(x,t) + a2u^{(2,0)}(x,t) - ia3u^{(3,0)}(x,t) + a4u^{(4,0)}(x,t) - ia5u^{(5,0)}(x,t) + a6u^{(6,0)}(x,t) - ia7u^{(7,0)}(x,t) + a8u^{(8,0)}(x,t) - bu(x,t)|u(x,t)|^2 + iu^{(0,1)}(x,t) = 0$$

Substitutions:

$$N = 4$$

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

$$z \rightarrow x - C0t$$

$$y(z) \rightarrow AR(z)^4$$

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

Imaginary part of equation after substitutions:

$$y'(z)(a1 - 2a2k - 3a3k^2 + 4a4k^3 + 5a5k^4 - 6a6k^5 - 7a7k^6 + 8a8k^7 - C0) + y^{(3)}(z)(a3 - 4a4k - 10a5k^2 + 10a6k^3 - 5a7k^4 + 6a8k^5 - 7a9k^6 + 8a10k^7 - C1) + y^{(5)}(z) - 6a6ky^{(5)}(z) - 21a7k^2y^{(5)}(z) + a7y^{(7)}(z) + 56a8k^3y^{(5)}(z) - 8a8ky^{(7)}(z) = 0$$

Real part of equation after substitutions:

$$y(z)(a1k - a2k^2 - a3k^3 + a4k^4 + a5k^5 - a6k^6 - a7k^7 + a8k^8 + \omega) + y''(z)(a2 + 3a3k - 6a4k^2 - 10a5k^3 + 10a6k^4 - 5a7k^5 + 6a8k^6 - 7a9k^7 + 8a10k^8 - C2) + a4y^{(4)}(z) + 5a5ky^{(4)}(z) - 15a6k^2y^{(4)}(z) + a6y^{(6)}(z) - 35a7k^3y^{(4)}(z) + 7a7ky^{(6)}(z) + 70a8k^4y^{(4)}(z) - 28a8k^2y^{(6)}(z) + a8y^{(8)}(z) - by(z)^3 = 0$$

Constraints on coefficients from imaginary part of equation:

$$a7 \rightarrow 8a8k$$

$$a5 \rightarrow 2(3a6k + 56a8k^3)$$

$$a3 \rightarrow 4(a4k + 10a6k^3 + 224a8k^5)$$

$$C0 \rightarrow a1 - 2a2k - 8a4k^3 - 96a6k^5 - 2176a8k^7$$

Constraints on coefficients from real part of equation:

$$b \rightarrow \frac{6652800a8\chi^4}{A^2}$$

$$a6 \rightarrow -4a8(7k^2 + 54)$$

$$a4 \rightarrow 2(35a8k^4 + 1620a8k^2 + 7752a8)$$

$$a2 \rightarrow -4(7a8k^6 + 810a8k^4 + 23256a8k^2 + 106816a8)$$

$$\omega \rightarrow -a1k - 7a8k^8 - 1080a8k^6 - 46512a8k^4 - 427264a8k^2 + 3686400a8$$

y(z) - function:

$$\frac{256a^4A}{(4a^2e^z + \chi e^{-z})^4}$$

u(x, t) - function:

$$\frac{256a^4Ae^{i(kx-\omega t)}}{(4a^2e^{C0t+x} + \chi e^{-C0t-x})^4}$$