Target equation:

$$-i\text{a}1u^{(1,0)}(x,t)+\text{a}10u^{(10,0)}(x,t)-i\text{a}11u^{(11,0)}(x,t)+\text{a}12u^{(12,0)}(x,t)-i\text{a}13u^{(13,0)}(x,t)+\text{a}14u^{(14,0)}(x,t)-i\text{a}15u^{(15,}$$

Substitutions:

$$N = 10$$
$$u(x,t) \to y(z)e^{i(kx-\omega t)}$$
$$z \to x - \text{C}0t$$
$$y(z) \to AR(z)^{10}$$
$$R'(z)^2 = R(z)^2\left(1 - \chi R(z)^2\right)$$

Imaginary part of equation after substitutions:

$$15504\text{a}20y^{(5)}(z)k^{15}-11628\text{a}19y^{(5)}(z)k^{14}-8568\text{a}18y^{(5)}(z)k^{13}-77520\text{a}20y^{(7)}(z)k^{13}+6188\text{a}17y^{(5)}(z)k^{12}+50388$$

Real part of equation after substitutions:

$$4845\text{a}20y^{(4)}(z)k^{16}-3876\text{a}19y^{(4)}(z)k^{15}-3060\text{a}18y^{(4)}(z)k^{14}-38760\text{a}20y^{(6)}(z)k^{14}+2380\text{a}17y^{(4)}(z)k^{13}+27132\text{a}19$$

Constraints on coefficients from imaginary part of equation:

$$\text{a}19 \to 20\text{a}20k$$
$$\text{a}17 \to 6\left(3\text{a}18k + 380\text{a}20k^3\right)$$
$$\text{a}15 \to 16\left(\text{a}16k + 102\text{a}18k^3 + 15504\text{a}20k\right)$$
$$\text{a}13 \to 2\left(7\text{a}14k + 560\text{a}16k^3 + 68544\text{a}18k^5 + 10542\right)$$
$$\text{a}11 \to 4\left(3\text{a}12k + 182\text{a}14k^3 + 17472\text{a}16k^5 + 2164032\text{a}18k^7\right)$$
$$\text{a}9 \to 2\left(5\text{a}10k + 220\text{a}12k^3 + 16016\text{a}14k^5 + 1555840\text{a}16k^7 + 19292416\right)$$
$$\text{a}7 \to 8\left(30\text{a}10k^3 + 1584\text{a}12k^5 + 116688\text{a}14k^7 + 11348480\text{a}16k^9 + 1407384576\right)$$
$$\text{a}5 \to 2\left(2016\text{a}10k^5 + 107712\text{a}12k^7 + 7943936\text{a}14k^9 + 772681728\text{a}16k^{11} + 95825608704\text{a}1\right)$$
$$\text{a}3 \to 4k\left(8160\text{a}10k^6 + 436480\text{a}12k^8 + 32195072\text{a}14k^{10} + 3131555840\text{a}16k^{12} + 388366491648\text{a}18\right)$$
$$\text{C}0 \to \text{a}1 - 79360\text{a}10k^9 - 4245504\text{a}12k^{11} - 313155584\text{a}14k^{13} - 30460116992\text{a}16k^{15} - 3777576173568\text{a}18k$$

Constraints on coefficients from real part of equation:

$$a1$$

$$a10 \rightarrow -52\,(3553a$$

$$a8 \rightarrow 2\,(62985\text{a}20k^{12} + 86203260\text{a}20$$

$$a6 \rightarrow -8\,(4845\text{a}20k^{14} + 9142770\text{a}20k^{12} + 6749879\text{1}$$

$$a4 \rightarrow 4845\text{a}20k^{16} + 12056400\text{a}20k^{14} + 12272507520\text{a}20k^{12} + 6594079977$$

$$a2 \rightarrow -2\,(95\text{a}20k^{18} + 301410\text{a}20k^{16} + 404588160\text{a}20k^{14} + 299730907840\text{a}20k^{12} + 1339$$

$$\omega \rightarrow -\text{a}1k - 19\text{a}20k^{20} - 66980\text{a}20k^{18} - 101147040\text{a}20k^{16} - 85637402240\text{a}20k^{14} - 44647129136896\text{a}20k^{12}$$