

Target equation:

$$\begin{aligned}
& -ia_1u^{(1,0)}(x,t)+a_{10}u^{(10,0)}(x,t)-ia_{11}u^{(11,0)}(x,t)+a_{12}u^{(12,0)}(x,t)-ia_{13}u^{(13,0)}(x,t)+a_{14}u^{(14,0)}(x,t)- \\
& ia_{15}u^{(15,0)}(x,t)+a_{16}u^{(16,0)}(x,t)-ia_{17}u^{(17,0)}(x,t)+a_{18}u^{(18,0)}(x,t)-ia_{19}u^{(19,0)}(x,t)+a_2u^{(2,0)}(x,t)+ \\
& a_{20}u^{(20,0)}(x,t)-ia_{21}u^{(21,0)}(x,t)+a_{22}u^{(22,0)}(x,t)-ia_{23}u^{(23,0)}(x,t)+a_{24}u^{(24,0)}(x,t)-ia_{25}u^{(25,0)}(x,t)+ \\
& a_{26}u^{(26,0)}(x,t)-ia_{27}u^{(27,0)}(x,t)+a_{28}u^{(28,0)}(x,t)-ia_{29}u^{(29,0)}(x,t)-ia_3u^{(3,0)}(x,t)+a_{30}u^{(30,0)}(x,t)+ \\
& a_4u^{(4,0)}(x,t)-ia_5u^{(5,0)}(x,t)+a_6u^{(6,0)}(x,t)-ia_7u^{(7,0)}(x,t)+a_8u^{(8,0)}(x,t)-ia_9u^{(9,0)}(x,t)-bu(x,t)|u(x,t)|^2+ \\
& iu^{(0,1)}(x,t) = 0
\end{aligned}$$

Substitutions:

$$N = 15$$

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

$$z \rightarrow x - C_0t$$

$$y(z) \rightarrow AR(z)^{15}$$

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

Imaginary part of equation after substitutions:

$$\begin{aligned}
& -142506a_{30}y^{(5)}(z)k^{25}+118755a_{29}y^{(5)}(z)k^{24}+98280a_{28}y^{(5)}(z)k^{23}+2035800a_{30}y^{(7)}(z)k^{23}-80730a_{27}y^{(5)}(z)k^{22}- \\
& 1560780a_{29}y^{(7)}(z)k^{22}-65780a_{26}y^{(5)}(z)k^{21}-1184040a_{28}y^{(7)}(z)k^{21}-14307150a_{30}y^{(9)}(z)k^{21}+53130a_{25}y^{(5)}(z)k^{20} \\
& 888030a_{27}y^{(7)}(z)k^{20}+10015005a_{29}y^{(9)}(z)k^{20}+42504a_{24}y^{(5)}(z)k^{19}+657800a_{26}y^{(7)}(z)k^{19}+6906900a_{28}y^{(9)}(z)k^{19} \\
& 54627300a_{30}y^{(11)}(z)k^{19}-33649a_{23}y^{(5)}(z)k^{18}-480700a_{25}y^{(7)}(z)k^{18}-4686825a_{27}y^{(9)}(z)k^{18}-34597290a_{29}y^{(11)}(z)k^{18} \\
& 26334a_{22}y^{(5)}(z)k^{17}-346104a_{24}y^{(7)}(z)k^{17}-3124550a_{26}y^{(9)}(z)k^{17}-21474180a_{28}y^{(11)}(z)k^{17}-119759850a_{30}y^{(13)}(z)k^{17} \\
& 20349a_{21}y^{(5)}(z)k^{16}+245157a_{23}y^{(7)}(z)k^{16}+2042975a_{25}y^{(9)}(z)k^{16}+13037895a_{27}y^{(11)}(z)k^{16}+67863915a_{29}y^{(13)}(z)k^{16} \\
& 15504a_{20}y^{(5)}(z)k^{15}+170544a_{22}y^{(7)}(z)k^{15}+1307504a_{24}y^{(9)}(z)k^{15}+7726160a_{26}y^{(11)}(z)k^{15}+37442160a_{28}y^{(13)}(z)k^{15} \\
& 155117520a_{30}y^{(15)}(z)k^{15}-11628a_{19}y^{(5)}(z)k^{14}-116280a_{21}y^{(7)}(z)k^{14}-817190a_{23}y^{(9)}(z)k^{14}-4457400a_{25}y^{(11)}(z)k^{14} \\
& 20058300a_{27}y^{(13)}(z)k^{14}-77558760a_{29}y^{(15)}(z)k^{14}-8568a_{18}y^{(5)}(z)k^{13}-77520a_{20}y^{(7)}(z)k^{13}-497420a_{22}y^{(9)}(z)k^{13} \\
& 2496144a_{24}y^{(11)}(z)k^{13}-10400600a_{26}y^{(13)}(z)k^{13}-37442160a_{28}y^{(15)}(z)k^{13}-119759850a_{30}y^{(17)}(z)k^{13}+ \\
& 6188a_{17}y^{(5)}(z)k^{12}+50388a_{19}y^{(7)}(z)k^{12}+293930a_{21}y^{(9)}(z)k^{12}+1352078a_{23}y^{(11)}(z)k^{12}+5200300a_{25}y^{(13)}(z)k^{12}+ \\
& 17383860a_{27}y^{(15)}(z)k^{12}+51895935a_{29}y^{(17)}(z)k^{12}+4368a_{16}y^{(5)}(z)k^{11}+31824a_{18}y^{(7)}(z)k^{11}+167960a_{20}y^{(9)}(z)k^{11} \\
& 705432a_{22}y^{(11)}(z)k^{11}+2496144a_{24}y^{(13)}(z)k^{11}+7726160a_{26}y^{(15)}(z)k^{11}+21474180a_{28}y^{(17)}(z)k^{11}+ \\
& 54627300a_{30}y^{(19)}(z)k^{11}-3003a_{15}y^{(5)}(z)k^{10}-19448a_{17}y^{(7)}(z)k^{10}-92378a_{19}y^{(9)}(z)k^{10}-352716a_{21}y^{(11)}(z)k^{10}- \\
& 1144066a_{23}y^{(13)}(z)k^{10}-3268760a_{25}y^{(15)}(z)k^{10}-8436285a_{27}y^{(17)}(z)k^{10}-20030010a_{29}y^{(19)}(z)k^{10}- \\
& 2002a_{14}y^{(5)}(z)k^9-11440a_{16}y^{(7)}(z)k^9-48620a_{18}y^{(9)}(z)k^9-167960a_{20}y^{(11)}(z)k^9-497420a_{22}y^{(13)}(z)k^9- \\
& 1307504a_{24}y^{(15)}(z)k^9-3124550a_{26}y^{(17)}(z)k^9-6906900a_{28}y^{(19)}(z)k^9-14307150a_{30}y^{(21)}(z)k^9+ \\
& 1287a_{13}y^{(5)}(z)k^8+6435a_{15}y^{(7)}(z)k^8+24310a_{17}y^{(9)}(z)k^8+75582a_{19}y^{(11)}(z)k^8+203490a_{21}y^{(13)}(z)k^8+ \\
& 490314a_{23}y^{(15)}(z)k^8+1081575a_{25}y^{(17)}(z)k^8+2220075a_{27}y^{(19)}(z)k^8+4292145a_{29}y^{(21)}(z)k^8+792a_{12}y^{(5)}(z)k^7+ \\
& 3432a_{14}y^{(7)}(z)k^7+11440a_{16}y^{(9)}(z)k^7+31824a_{18}y^{(11)}(z)k^7+77520a_{20}y^{(13)}(z)k^7+170544a_{22}y^{(15)}(z)k^7+
\end{aligned}$$

$$\begin{aligned}
& 346104a_{24}y^{(17)}(z)k^7 + 657800a_{26}y^{(19)}(z)k^7 + 1184040a_{28}y^{(21)}(z)k^7 + 2035800a_{30}y^{(23)}(z)k^7 - 462a_{11}y^{(5)}(z)k^6 - \\
& 1716a_{13}y^{(7)}(z)k^6 - 5005a_{15}y^{(9)}(z)k^6 - 12376a_{17}y^{(11)}(z)k^6 - 27132a_{19}y^{(13)}(z)k^6 - 54264a_{21}y^{(15)}(z)k^6 - \\
& 100947a_{23}y^{(17)}(z)k^6 - 177100a_{25}y^{(19)}(z)k^6 - 296010a_{27}y^{(21)}(z)k^6 - 475020a_{29}y^{(23)}(z)k^6 - 252a_{10}y^{(5)}(z)k^5 - \\
& 792a_{12}y^{(7)}(z)k^5 - 2002a_{14}y^{(9)}(z)k^5 - 4368a_{16}y^{(11)}(z)k^5 - 8568a_{18}y^{(13)}(z)k^5 - 15504a_{20}y^{(15)}(z)k^5 - \\
& 26334a_{22}y^{(17)}(z)k^5 - 42504a_{24}y^{(19)}(z)k^5 - 65780a_{26}y^{(21)}(z)k^5 - 98280a_{28}y^{(23)}(z)k^5 - 142506a_{30}y^{(25)}(z)k^5 + \\
& 126a_9y^{(5)}(z)k^4 + 330a_{11}y^{(7)}(z)k^4 + 715a_{13}y^{(9)}(z)k^4 + 1365a_{15}y^{(11)}(z)k^4 + 2380a_{17}y^{(13)}(z)k^4 + \\
& 3876a_{19}y^{(15)}(z)k^4 + 5985a_{21}y^{(17)}(z)k^4 + 8855a_{23}y^{(19)}(z)k^4 + 12650a_{25}y^{(21)}(z)k^4 + 17550a_{27}y^{(23)}(z)k^4 + \\
& 23751a_{29}y^{(25)}(z)k^4 + 56a_8y^{(5)}(z)k^3 + 120a_{10}y^{(7)}(z)k^3 + 220a_{12}y^{(9)}(z)k^3 + 364a_{14}y^{(11)}(z)k^3 + 560a_{16}y^{(13)}(z)k^3 + \\
& 816a_{18}y^{(15)}(z)k^3 + 1140a_{20}y^{(17)}(z)k^3 + 1540a_{22}y^{(19)}(z)k^3 + 2024a_{24}y^{(21)}(z)k^3 + 2600a_{26}y^{(23)}(z)k^3 + \\
& 3276a_{28}y^{(25)}(z)k^3 + 4060a_{30}y^{(27)}(z)k^3 - 21a_7y^{(5)}(z)k^2 - 36a_9y^{(7)}(z)k^2 - 55a_{11}y^{(9)}(z)k^2 - 78a_{13}y^{(11)}(z)k^2 - \\
& 105a_{15}y^{(13)}(z)k^2 - 136a_{17}y^{(15)}(z)k^2 - 171a_{19}y^{(17)}(z)k^2 - 210a_{21}y^{(19)}(z)k^2 - 253a_{23}y^{(21)}(z)k^2 - \\
& 300a_{25}y^{(23)}(z)k^2 - 351a_{27}y^{(25)}(z)k^2 - 406a_{29}y^{(27)}(z)k^2 - 6a_6y^{(5)}(z)k - 8a_8y^{(7)}(z)k - 10a_{10}y^{(9)}(z)k - \\
& 12a_{12}y^{(11)}(z)k - 14a_{14}y^{(13)}(z)k - 16a_{16}y^{(15)}(z)k - 18a_{18}y^{(17)}(z)k - 20a_{20}y^{(19)}(z)k - 22a_{22}y^{(21)}(z)k - \\
& 24a_{24}y^{(23)}(z)k - 26a_{26}y^{(25)}(z)k - 28a_{28}y^{(27)}(z)k - 30a_{30}y^{(29)}(z)k + (a_1 - C_0 + k(k(4a_4 + k(5a_5 + k(k(8a_6 + k(12a_7 + k(16a_8 + k(20a_9 + k(24a_{10} + k(28a_{11} + k(32a_{12} + k(36a_{13} + k(40a_{14} + k(44a_{15} + k(48a_{16} + k(52a_{17} + k(56a_{18} + k(60a_{19} + k(64a_{20} + k(68a_{21} + k(72a_{22} + k(76a_{23} + k(80a_{24} + k(84a_{25} + k(88a_{26} + k(92a_{27} + k(96a_{28} + k(100a_{29} + k(104a_{30} + k(108a_1 + k(112a_2 + k(116a_3 + k(120a_4 + k(124a_5 + k(128a_6 + k(132a_7 + k(136a_8 + k(140a_9 + k(144a_{10} + k(148a_{11} + k(152a_{12} + k(156a_{13} + k(160a_{14} + k(164a_{15} + k(168a_{16} + k(172a_{17} + k(176a_{18} + k(180a_{19} + k(184a_{20} + k(188a_{21} + k(192a_{22} + k(196a_{23} + k(200a_{24} + k(204a_{25} + k(208a_{26} + k(212a_{27} + k(216a_{28} + k(220a_{29} + k(224a_{30} + k(228a_1 + k(232a_2 + k(236a_3 + k(240a_4 + k(244a_5 + k(248a_6 + k(252a_7 + k(256a_8 + k(260a_9 + k(264a_{10} + k(268a_{11} + k(272a_{12} + k(276a_{13} + k(280a_{14} + k(284a_{15} + k(288a_{16} + k(292a_{17} + k(296a_{18} + k(300a_{19} + k(304a_{20} + k(308a_{21} + k(312a_{22} + k(316a_{23} + k(320a_{24} + k(324a_{25} + k(328a_{26} + k(332a_{27} + k(336a_{28} + k(340a_{29} + k(344a_{30} + k(348a_1 + k(352a_2 + k(356a_3 + k(360a_4 + k(364a_5 + k(368a_6 + k(372a_7 + k(376a_8 + k(380a_9 + k(384a_{10} + k(388a_{11} + k(392a_{12} + k(396a_{13} + k(400a_{14} + k(404a_{15} + k(408a_{16} + k(412a_{17} + k(416a_{18} + k(420a_{19} + k(424a_{20} + k(428a_{21} + k(432a_{22} + k(436a_{23} + k(440a_{24} + k(444a_{25} + k(448a_{26} + k(452a_{27} + k(456a_{28} + k(460a_{29} + k(464a_{30} + k(468a_1 + k(472a_2 + k(476a_3 + k(480a_4 + k(484a_5 + k(488a_6 + k(492a_7 + k(496a_8 + k(500a_9 + k(504a_{10} + k(508a_{11} + k(512a_{12} + k(516a_{13} + k(520a_{14} + k(524a_{15} + k(528a_{16} + k(532a_{17} + k(536a_{18} + k(540a_{19} + k(544a_{20} + k(548a_{21} + k(552a_{22} + k(556a_{23} + k(560a_{24} + k(564a_{25} + k(568a_{26} + k(572a_{27} + k(576a_{28} + k(580a_{29} + k(584a_{30} + k(588a_1 + k(592a_2 + k(596a_3 + k(600a_4 + k(604a_5 + k(608a_6 + k(612a_7 + k(616a_8 + k(620a_9 + k(624a_{10} + k(628a_{11} + k(632a_{12} + k(636a_{13} + k(640a_{14} + k(644a_{15} + k(648a_{16} + k(652a_{17} + k(656a_{18} + k(660a_{19} + k(664a_{20} + k(668a_{21} + k(672a_{22} + k(676a_{23} + k(680a_{24} + k(684a_{25} + k(688a_{26} + k(692a_{27} + k(696a_{28} + k(700a_{29} + k(704a_{30} + k(708a_1 + k(712a_2 + k(716a_3 + k(720a_4 + k(724a_5 + k(728a_6 + k(732a_7 + k(736a_8 + k(740a_9 + k(744a_{10} + k(748a_{11} + k(752a_{12} + k(756a_{13} + k(760a_{14} + k(764a_{15} + k(768a_{16} + k(772a_{17} + k(776a_{18} + k(780a_{19} + k(784a_{20} + k(788a_{21} + k(792a_{22} + k(796a_{23} + k(800a_{24} + k(804a_{25} + k(808a_{26} + k(812a_{27} + k(816a_{28} + k(820a_{29} + k(824a_{30} + k(828a_1 + k(832a_2 + k(836a_3 + k(840a_4 + k(844a_5 + k(848a_6 + k(852a_7 + k(856a_8 + k(860a_9 + k(864a_{10} + k(868a_{11} + k(872a_{12} + k(876a_{13} + k(880a_{14} + k(884a_{15} + k(888a_{16} + k(892a_{17} + k(896a_{18} + k(900a_{19} + k(904a_{20} + k(908a_{21} + k(912a_{22} + k(916a_{23} + k(920a_{24} + k(924a_{25} + k(928a_{26} + k(932a_{27} + k(936a_{28} + k(940a_{29} + k(944a_{30} + k(948a_1 + k(952a_2 + k(956a_3 + k(960a_4 + k(964a_5 + k(968a_6 + k(972a_7 + k(976a_8 + k(980a_9 + k(984a_{10} + k(988a_{11} + k(992a_{12} + k(996a_{13} + k(1000a_{14} + k(1004a_{15} + k(1008a_{16} + k(1012a_{17} + k(1016a_{18} + k(1020a_{19} + k(1024a_{20} + k(1028a_{21} + k(1032a_{22} + k(1036a_{23} + k(1040a_{24} + k(1044a_{25} + k(1048a_{26} + k(1052a_{27} + k(1056a_{28} + k(1060a_{29} + k(1064a_{30} + k(1068a_1 + k(1072a_2 + k(1076a_3 + k(1080a_4 + k(1084a_5 + k(1088a_6 + k(1092a_7 + k(1096a_8 + k(1100a_9 + k(1104a_{10} + k(1108a_{11} + k(1112a_{12} + k(1116a_{13} + k(1120a_{14} + k(1124a_{15} + k(1128a_{16} + k(1132a_{17} + k(1136a_{18} + k(1140a_{19} + k(1144a_{20} + k(1148a_{21} + k(1152a_{22} + k(1156a_{23} + k(1160a_{24} + k(1164a_{25} + k(1168a_{26} + k(1172a_{27} + 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k(2024a_{30} + k(2028a_1 + k(2032a_2 + k(2036a_3 + k(2040a_4 + k(2044a_5 + k(2048a_6 + k(2052a_7 + k(2056a_8 + k(2060a_9 + k(2064a_{10} + k(2068a_{11} + k(2072a_{12} + k(2076a_{13} + k(2080a_{14} + k(2084a_{15} + k(2088a_{16} + k(2092a_{17} + k(2096a_{18} + k(2100a_{19} + k(2104a_{20} + k(2108a_{21} + k(2112a_{22} + k(2116a_{23} + k(2120a_{24} + k(2124a_{25} + k(2128a_{26} + k(2132a_{27} + k(2136a_{28} + k(2140a_{29} + k(2144a_{30} + k(2148a_1 + k(2152a_2 + k(2156a_3 + k(2160a_4 + k(2164a_5 + k(2168a_6 + k(2172a_7 + k(2176a_8 + k(2180a_9 + k(2184a_{10} + k(2188a_{11} + k(2192a_{12} + k(2196a_{13} + k(2200a_{14} + k(2204a_{15} + k(2208a_{16} + k(2212a_{17} + k(2216a_{18} + k(2220a_{19} + k(2224a_{20} + k(2228a_{21} + k(2232a_{22} + k(2236a_{23} + k(2240a_{24} + k(2244a_{25} + k(2248a_{26} + k(2252a_{27} + k(2256a_{28} + k(2260a_{29} + k(2264a_{30} + k(2268a_1 + k(2272a_2 + k(2276a_3 + k(2280a_4 + k(2284a_5 + k(2288a_6 + k(2292a_7 + k(2296a_8 + k(2300a_9 + k(2304a_{10} + k(2308a_{11} + 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+ k(3160a_{14} + k(3164a_{15} + k(3168a_{16} + k(3172a_{17} + k(3176a_{18} + k(3180a_{19} + k(3184a_{20} + k(3188a_{21} + k(3192a_{22} + k(3196a_{23} + k(3200a_{24} + k(3204a_{25} + k(3208a_{26} + k(3212a_{27} + k(3216a_{28} + k(3220a_{29} + k(3224a_{30} + k(3228a_1 + k(3232a_2 + k(3236a_3 + k(3240a_4 + k(3244a_5 + k(3248a_6 + k(3252a_7 + k(3256a_8 + k(3260a_9 + k(3264a_{10} + k(3268a_{11} + k(3272a_{12} + k(3276a_{13} + k(3280a_{14} + k(3284a_{15} + k(3288a_{16} + k(3292a_{17} + k(3296a_{18} + k(3300a_{19} + k(3304a_{20} + k(3308a_{21} + k(3312a_{22} + k(3316a_{23} + k(3320a_{24} + k(3324a_{25} + k(3328a_{26} + k(3332a_{27} + k(3336a_{28} + k(3340a_{29} + k(3344a_{30} + k(3348a_1 + k(3352a_2 + k(3356a_3 + k(3360a_4 + k(3364a_5 + k(3368a_6 + k(3372a_7 + k(3376a_8 + k(3380a_9 + k(3384a_{10} + k(3388a_{11} + k(3392a_{12} + k(3396a_{13} + k(3400a_{14} + k(3404a_{15} + k(3408a_{16} + k(3412a_{17} + k(3416a_{18} + k(3420a_{19} + k(3424a_{20} + k(3428a_{21} + k(3432a_{22} + k(3436a_{23} + 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$$\begin{aligned}
& 1961256a_{24}y^{(14)}(z)k^{10} - 5311735a_{26}y^{(16)}(z)k^{10} - 13123110a_{28}y^{(18)}(z)k^{10} - 30045015a_{30}y^{(20)}(z)k^{10} + \\
& 715a_{13}y^{(4)}(z)k^9 + 5005a_{15}y^{(6)}(z)k^9 + 24310a_{17}y^{(8)}(z)k^9 + 92378a_{19}y^{(10)}(z)k^9 + 293930a_{21}y^{(12)}(z)k^9 + \blacksquare \\
& 817190a_{23}y^{(14)}(z)k^9 + 2042975a_{25}y^{(16)}(z)k^9 + 4686825a_{27}y^{(18)}(z)k^9 + 10015005a_{29}y^{(20)}(z)k^9 + \\
& 495a_{12}y^{(4)}(z)k^8 + 3003a_{14}y^{(6)}(z)k^8 + 12870a_{16}y^{(8)}(z)k^8 + 43758a_{18}y^{(10)}(z)k^8 + 125970a_{20}y^{(12)}(z)k^8 + \blacksquare \\
& 319770a_{22}y^{(14)}(z)k^8 + 735471a_{24}y^{(16)}(z)k^8 + 1562275a_{26}y^{(18)}(z)k^8 + 3108105a_{28}y^{(20)}(z)k^8 + 5852925a_{30}y^{(22)}(z)k^8 + \\
& 330a_{11}y^{(4)}(z)k^7 - 1716a_{13}y^{(6)}(z)k^7 - 6435a_{15}y^{(8)}(z)k^7 - 19448a_{17}y^{(10)}(z)k^7 - 50388a_{19}y^{(12)}(z)k^7 - \\
& 116280a_{21}y^{(14)}(z)k^7 - 245157a_{23}y^{(16)}(z)k^7 - 480700a_{25}y^{(18)}(z)k^7 - 888030a_{27}y^{(20)}(z)k^7 - 1560780a_{29}y^{(22)}(z)k^7 - \\
& 210a_{10}y^{(4)}(z)k^6 - 924a_{12}y^{(6)}(z)k^6 - 3003a_{14}y^{(8)}(z)k^6 - 8008a_{16}y^{(10)}(z)k^6 - 18564a_{18}y^{(12)}(z)k^6 - \\
& 38760a_{20}y^{(14)}(z)k^6 - 74613a_{22}y^{(16)}(z)k^6 - 134596a_{24}y^{(18)}(z)k^6 - 230230a_{26}y^{(20)}(z)k^6 - 376740a_{28}y^{(22)}(z)k^6 - \blacksquare \\
& 593775a_{30}y^{(24)}(z)k^6 + 126a_9y^{(4)}(z)k^5 + 462a_{11}y^{(6)}(z)k^5 + 1287a_{13}y^{(8)}(z)k^5 + 3003a_{15}y^{(10)}(z)k^5 + \\
& 6188a_{17}y^{(12)}(z)k^5 + 11628a_{19}y^{(14)}(z)k^5 + 20349a_{21}y^{(16)}(z)k^5 + 33649a_{23}y^{(18)}(z)k^5 + 53130a_{25}y^{(20)}(z)k^5 + \blacksquare \\
& 80730a_{27}y^{(22)}(z)k^5 + 118755a_{29}y^{(24)}(z)k^5 + 70a_8y^{(4)}(z)k^4 + 210a_{10}y^{(6)}(z)k^4 + 495a_{12}y^{(8)}(z)k^4 + \\
& 1001a_{14}y^{(10)}(z)k^4 + 1820a_{16}y^{(12)}(z)k^4 + 3060a_{18}y^{(14)}(z)k^4 + 4845a_{20}y^{(16)}(z)k^4 + 7315a_{22}y^{(18)}(z)k^4 + \\
& 10626a_{24}y^{(20)}(z)k^4 + 14950a_{26}y^{(22)}(z)k^4 + 20475a_{28}y^{(24)}(z)k^4 + 27405a_{30}y^{(26)}(z)k^4 - 35a_7y^{(4)}(z)k^3 - \\
& 84a_9y^{(6)}(z)k^3 - 165a_{11}y^{(8)}(z)k^3 - 286a_{13}y^{(10)}(z)k^3 - 455a_{15}y^{(12)}(z)k^3 - 680a_{17}y^{(14)}(z)k^3 - 969a_{19}y^{(16)}(z)k^3 - \blacksquare \\
& 1330a_{21}y^{(18)}(z)k^3 - 1771a_{23}y^{(20)}(z)k^3 - 2300a_{25}y^{(22)}(z)k^3 - 2925a_{27}y^{(24)}(z)k^3 - 3654a_{29}y^{(26)}(z)k^3 - \\
& 15a_6y^{(4)}(z)k^2 - 28a_8y^{(6)}(z)k^2 - 45a_{10}y^{(8)}(z)k^2 - 66a_{12}y^{(10)}(z)k^2 - 91a_{14}y^{(12)}(z)k^2 - 120a_{16}y^{(14)}(z)k^2 - \blacksquare \\
& 153a_{18}y^{(16)}(z)k^2 - 190a_{20}y^{(18)}(z)k^2 - 231a_{22}y^{(20)}(z)k^2 - 276a_{24}y^{(22)}(z)k^2 - 325a_{26}y^{(24)}(z)k^2 - \\
& 378a_{28}y^{(26)}(z)k^2 - 435a_{30}y^{(28)}(z)k^2 + 5a_5y^{(4)}(z)k + 7a_7y^{(6)}(z)k + 9a_9y^{(8)}(z)k + 11a_{11}y^{(10)}(z)k + \\
& 13a_{13}y^{(12)}(z)k + 15a_{15}y^{(14)}(z)k + 17a_{17}y^{(16)}(z)k + 19a_{19}y^{(18)}(z)k + 21a_{21}y^{(20)}(z)k + 23a_{23}y^{(22)}(z)k + \\
& 25a_{25}y^{(24)}(z)k + 27a_{27}y^{(26)}(z)k + 29a_{29}y^{(28)}(z)k - by(z)^3 + (-a_{30}k^{30} + a_{29}k^{29} + a_{28}k^{28} - a_{27}k^{27} - a_{26}k^{26} + a_{25}k^{25} \\
& (a_2 + k(3a_3 + k(k(15a_6 + k(21a_7 + k(k(45a_{10} + k(55a_{11} + k(k(91a_{14} + k(105a_{15} + k(k(153a_{17} \\
& a_4y^{(4)}(z) + a_6y^{(6)}(z) + a_8y^{(8)}(z) + a_{10}y^{(10)}(z) + a_{12}y^{(12)}(z) + a_{14}y^{(14)}(z) + a_{16}y^{(16)}(z) + a_{18}y^{(18)}(z) + \\
& a_{20}y^{(20)}(z) + a_{22}y^{(22)}(z) + a_{24}y^{(24)}(z) + a_{26}y^{(26)}(z) + a_{28}y^{(28)}(z) + a_{30}y^{(30)}(z) = 0
\end{aligned}$$

Constraints on coefficients from imaginary part of equation:

$$a_{29} \rightarrow 30a_{30}k$$

$$a_{27} \rightarrow 28a_{28}k + 8120a_{30}k^3$$

$$a_{25} \rightarrow 26a_{26}k + 6552a_{28}k^3 + 2280096a_{30}k^5$$

$$a_{23} \rightarrow 24a_{24}k + 5200a_{26}k^3 + 1572480a_{28}k^5 + 553737600a_{30}k^7$$

$$a_{21} \rightarrow 22a_{22}k + 4048a_{24}k^3 + 1052480a_{26}k^5 + 322058880a_{28}k^7 + 113541542400a_{30}k^9$$

$$a_{19} \rightarrow 20a_{20}k + 3080a_{22}k^3 + 680064a_{24}k^5 + 178921600a_{26}k^7 + 54813158400a_{28}k^9 + 19326701721600a_{30}k^{11} \blacksquare$$

$$a_{17} \rightarrow 18a_{18}k + 2280a_{20}k^3 + 421344a_{22}k^5 + 94140288a_{24}k^7 + 24796428800a_{26}k^9 + 7597393090560a_{28}k^{11} + \blacksquare$$

$$2678818983321600a_{30}k^{13}$$

$$a_{15} \rightarrow 16a_{16}k + 1632a_{18}k^3 + 248064a_{20}k^5 + 46387968a_{22}k^7 + 10376351744a_{24}k^9 + 2733453598720a_{26}k^{11} + \blacksquare$$

$$\begin{aligned}
& 837515820072960a_{28}k^{13} + 295306112919306240a_{30}k^{15} \\
& a_{13} \rightarrow 14a_{14}k + 1120a_{16}k^3 + 137088a_{18}k^5 + 21085440a_{20}k^7 + 3947525120a_{22}k^9 + 883115778048a_{24}k^{11} + \blacksquare \\
& 232643283353600a_{26}k^{13} + 71280785877073920a_{28}k^{15} + 25133441995004313600a_{30}k^{17} \\
& a_{11} \rightarrow 12a_{12}k + 728a_{14}k^3 + 69888a_{16}k^5 + 8656128a_{18}k^7 + 1332930560a_{20}k^9 + 249576198144a_{22}k^{11} + \\
& 55834388004864a_{24}k^{13} + 14708733593681920a_{26}k^{15} + 4506686150828359680a_{28}k^{17} + 1589047253724207513600a_{30}k^{19} \\
& a_9 \rightarrow 10a_{10}k + 440a_{12}k^3 + 32032a_{14}k^5 + 3111680a_{16}k^7 + 385848320a_{18}k^9 + 59422904320a_{20}k^{11} + \\
& 11126417899520a_{22}k^{13} + 2489170300469248a_{24}k^{15} + 655734757395660800a_{26}k^{17} + 200914020585819340800a_{28}k^{19} \\
& 70841825370754410086400a_{30}k^{21} \\
& a_7 \rightarrow 240a_{10}k^3 + 12672a_{12}k^5 + 933504a_{14}k^7 + 90787840a_{16}k^9 + 11259076608a_{18}k^{11} + 1733987205120a_{20}k^{13} + \blacksquare \\
& 324674387017728a_{22}k^{15} + 72635234665365504a_{24}k^{17} + 19134668627220889600a_{26}k^{19} + 586277175482105462784a_{28}k^{21} \\
& 2067199948150650018201600a_{30}k^{23} + 8a_8k \\
& a_5 \rightarrow 4032a_{10}k^5 + 215424a_{12}k^7 + 15887872a_{14}k^9 + 1545363456a_{16}k^{11} + 191651217408a_{18}k^{13} + \\
& 29515853365248a_{20}k^{15} + 5526593941929984a_{22}k^{17} + 1236393972835811328a_{24}k^{19} + 325709541934503034880a_{26}k^{21} \\
& 99795859565893449154560a_{28}k^{23} + 35187792455985778913181696a_{30}k^{25} + 6a_6k + 112a_8k^3 \\
& a_3 \rightarrow 32640a_{10}k^7 + 1745920a_{12}k^9 + 128780288a_{14}k^{11} + 12526223360a_{16}k^{13} + 1553465966592a_{18}k^{15} + \blacksquare \\
& 239246490992640a_{20}k^{17} + 44796883073761280a_{22}k^{19} + 10021832059523170304a_{24}k^{21} + 264010210491781611520a_{26}k^{23} \\
& 808914769103121354326016a_{28}k^{25} + 285221502512012477144760320a_{30}k^{27} + 4a_4k + 40a_6k^3 + \\
& 896a_8k^5 \\
& C0 \rightarrow a_1 - 79360a_{10}k^9 - 4245504a_{12}k^{11} - 313155584a_{14}k^{13} - 30460116992a_{16}k^{15} - 3777576173568a_{18}k^{17} - \blacksquare \\
& 2a_2k - 581777702256640a_{20}k^{19} - 108932957168730112a_{22}k^{21} - 24370173276164456448a_{24}k^{23} - \\
& 6419958484945407574016a_{26}k^{25} - 1967044844910430876860416a_{28}k^{27} - 693575525634287935244206080a_{30}k^{29} \\
& 8a_4k^3 - 96a_6k^5 - 2176a_8k^7 \\
& \text{Constraints on coefficients from real part of equation:} \\
& b \rightarrow -\frac{30492356964074661376749098415622717440000000a_{30}\chi^{15}}{A^2} \\
& a_{28} \rightarrow -435a_{30}k^2 - 13735a_{30} \\
& a_{26} \rightarrow 27405a_{30}k^4 + 5191830a_{30}k^2 + 86119929a_{30} \\
& a_{24} \rightarrow -593775a_{30}k^6 - 281224125a_{30}k^4 - 27988976925a_{30}k^2 - 326725589775a_{30} \\
& a_{22} \rightarrow 5852925a_{30}k^8 + 5174523900a_{30}k^6 + 1287492938550a_{30}k^4 + 90176262777900a_{30}k^2 + 838048249054965a_{30} \\
& a_{20} \rightarrow -30045015a_{30}k^{10} - 42689822175a_{30}k^8 - 19827391253670a_{30}k^6 - 3471786116949150a_{30}k^4 - \\
& 193589145531696915a_{30}k^2 - 1538070385569865875a_{30} \\
& a_{18} \rightarrow 86493225a_{30}k^{12} + 180245915850a_{30}k^{10} + 134543012078475a_{30}k^8 + 43975957481355900a_{30}k^6 + \blacksquare \\
& 6130322941837068975a_{30}k^4 + 292233373258274516250a_{30}k^2 + 2084625297546283166205a_{30} \\
& a_{16} \rightarrow -145422675a_{30}k^{14} - 417842804925a_{30}k^{12} - 457446241066815a_{30}k^{10} - 240297196237409025a_{30}k^8 - \blacksquare \\
& 62529294006738103545a_{30}k^6 - 7451951018086000164375a_{30}k^4 - 318947670524581324429365a_{30}k^2 - \blacksquare
\end{aligned}$$

$$2122653259653203927325675a_{30}$$

$$\begin{aligned} a_{14} \rightarrow & 145422675a_{30}k^{16} + 551001501000a_{30}k^{14} + 831720438303300a_{30}k^{12} + 640792523299757400a_{30}k^{10} + \blacksquare \\ & 267982688600306158050a_{30}k^8 + 59615608144688001315000a_{30}k^6 + 6378953410491626488587300a_{30}k^4 + \blacksquare \\ & 254718391158384471279081000a_{30}k^2 + 1635540164393495008557522915a_{30} \\ a_{12} \rightarrow & -86493225a_{30}k^{18} - 417842804925a_{30}k^{16} - 831720438303300a_{30}k^{14} - 883516963943604900a_{30}k^{12} - \blacksquare \\ & 541920548058396897390a_{30}k^{10} - 193750726470236004273750a_{30}k^8 - 38698984023649200697429620a_{30}k^6 - \blacksquare \\ & 3863228932568831147732728500a_{30}k^4 - 148834154959808045778734585265a_{30}k^2 - 9526527299029151826359 \\ a_{10} \rightarrow & 30045015a_{30}k^{20} + 180245915850a_{30}k^{18} + 457446241066815a_{30}k^{16} + 640792523299757400a_{30}k^{14} + \blacksquare \\ & 541920548058396897390a_{30}k^{12} + 284167732156346139601500a_{30}k^{10} + 91219033770030258786798390a_{30}k^8 + \blacksquare \\ & 16998207303302857050024005400a_{30}k^6 + 1637175704557888503566080437915a_{30}k^4 + 62875080173592402053 \\ & 415613161646004360806812051205419a_{30} \\ a_8 \rightarrow & -5852925a_{30}k^{22} - 42689822175a_{30}k^{20} - 134543012078475a_{30}k^{18} - 240297196237409025a_{30}k^{16} - \blacksquare \\ & 267982688600306158050a_{30}k^{14} - 193750726470236004273750a_{30}k^{12} - 91219033770030258786798390a_{30}k^{10} - \blacksquare \\ & 27318547451736734544681437250a_{30}k^8 - 4911527113673665510698241313745a_{30}k^6 - 47156310130194301540 \\ & 18702592274070196236306542304243855a_{30}k^2 - 133228564494657551049851682459117165a_{30} \\ a_6 \rightarrow & 593775a_{30}k^{24} + 5174523900a_{30}k^{22} + 19827391253670a_{30}k^{20} + 43975957481355900a_{30}k^{18} + \\ & 62529294006738103545a_{30}k^{16} + 59615608144688001315000a_{30}k^{14} + 38698984023649200697429620a_{30}k^{12} + \blacksquare \\ & 16998207303302857050024005400a_{30}k^{10} + 4911527113673665510698241313745a_{30}k^8 + 8802511224302936287 \\ & 87278763945660915769430530753137990a_{30}k^4 + 3730399805850411429395847108855280620a_{30}k^2 + \blacksquare \\ & 30343860264122626269478142574287161191a_{30} \\ a_4 \rightarrow & -27405a_{30}k^{26} - 281224125a_{30}k^{24} - 1287492938550a_{30}k^{22} - 3471786116949150a_{30}k^{20} - \\ & 6130322941837068975a_{30}k^{18} - 7451951018086000164375a_{30}k^{16} - 6378953410491626488587300a_{30}k^{14} - \blacksquare \\ & 3863228932568831147732728500a_{30}k^{12} - 1637175704557888503566080437915a_{30}k^{10} - 47156310130194301540 \\ & 87278763945660915769430530753137990a_{30}k^6 - 9325999514626028573489617772138201550a_{30}k^4 - \blacksquare \\ & 455157903961839394042172138614307417865a_{30}k^2 - 4630661692484083313035746144957742083825a_{30} \\ a_2 \rightarrow & 435a_{30}k^{28} + 5191830a_{30}k^{26} + 27988976925a_{30}k^{24} + 90176262777900a_{30}k^{22} + 193589145531696915a_{30}k^{20} + \\ & 292233373258274516250a_{30}k^{18} + 318947670524581324429365a_{30}k^{16} + 254718391158384471279081000a_{30}k^{14} + \\ & 148834154959808045778734585265a_{30}k^{12} + 62875080173592402053972484729450a_{30}k^{10} + 18702592274070190 \\ & 3730399805850411429395847108855280620a_{30}k^6 + 455157903961839394042172138614307417865a_{30}k^4 + \blacksquare \\ & 27783970154904499878214476869746452502950a_{30}k^2 + 422939763786947441219143966710178037769375a_{30} \\ \omega \rightarrow & -a_1k + 29a_{30}k^{30} + 370845a_{30}k^{28} + 2152998225a_{30}k^{26} + 7514688564825a_{30}k^{24} + 17599013230154265a_{30}k^{22} + \\ & 29223337325827451625a_{30}k^{20} + 35438630058286813825485a_{30}k^{18} + 31839798894798058909885125a_{30}k^{16} + \blacksquare \\ & 21262022137115435111247797895a_{30}k^{14} + 10479180028932067008995414121575a_{30}k^{12} + 374051845481403924 \\ & 932599951462602857348961777213820155a_{30}k^8 + 151719301320613131347390712871435805955a_{30}k^6 + \blacksquare \end{aligned}$$

$$13891985077452249939107238434873226251475a_{30}k^4+422939763786947441219143966710178037769375a_{30}k^3+17410450495992757948660282634885774797265625a_{30}k^2+1073741824a^{15}A$$

y(z) - function:

$$\frac{1073741824a^{15}A}{(4a^2e^z+\chi e^{-z})^{15}}$$

u(x, t) - function:

$$\frac{1073741824a^{15}Ae^{i(kx-\omega t)}}{(4a^2e^{C_0t+x}+\chi e^{-C_0t-x})^{15}}$$