Appendix

Chapter 2:

$$A_4 = \frac{(1+R)(1+0.5R)}{RbM^2} \qquad A_5 = \frac{-(2+R)}{M^2} \qquad A_6 = \frac{(1-m_1)}{M^2}$$

$$A_7 = \frac{-1}{M^2} \qquad A' = A_6 + A_7 \qquad a_1 = \frac{-Rb\,R}{(1+R)(1+0.5R)} + \frac{2Rb}{(1+0.5R)} + \frac{M^2}{(1+R)}$$

$$a_2 = \frac{2M^2Rb}{(1+R)(1+0.5R)} \qquad a_3 = \frac{(1-m_1)Rb}{(1+R)(1+0.5R)} \qquad \mathrm{k} = \; p^2 = {a_1}^2 - 4a_2$$

$$A = \frac{a_3}{a_2} \qquad p_1 = \frac{a1+p}{2} \qquad p_2 = \frac{a1-p}{2}$$

$$q_1 = \sqrt{\frac{a_1}{2}} \qquad q_2 = \sqrt{\frac{a_2}{2}} \qquad r = \sqrt{a_1}$$

$$v_1 = \sqrt{\frac{\sqrt{\frac{{a_1}^2}{4} + \frac{p^2}{4}} + \frac{a_1}{2}}{2}} \qquad v_2 = \sqrt{\frac{\sqrt{\frac{{a_1}^2}{4} + \frac{p^2}{4}} - \frac{a_1}{2}}{2}} \qquad b_1 = {p_1}^3 A_4$$

$$b_2 = {p_2}^3 A_4 \qquad b_3 = p_1 A_5 \qquad b_4 = A_5 p_2$$

$$b_5 = b_1 + b_3 \qquad b_6 = b_2 + b_4 \qquad b_7 = b_5(-A_1 - 1)$$

$$b_8 = b_5(-A_2 - 1) \qquad b_9 = b_5(-A_3 - A) \qquad b_{10} = c_3 b_7 + c_4 b_8 + b_9$$

$$b_{11} = A_1 c_3 b_5 + A_2 c_4 b_5 - A_3 b_5 \qquad A_1 = \frac{e^{p_1} - e^{p_2}}{e^{-p_1} - e^{p_1}} \qquad A_2 = \frac{e^{p_1} - e^{-p_2}}{e^{-p_1} - e^{p_1}}$$

$$A_3 = \frac{A(e^{p_1} - 1)}{e^{-p_1} - e^{p_1}} \qquad A_8 = -2b_5 A_1 - b_5 + b_6 \qquad A_9 = -2b_5 A_2 - b_5 - b_6$$

$$A_{10} = -2b_5 A_3 - Ab_5 + A_7 \qquad A_{11} = b_7 e^{p_1} - A_1 b_5 e^{-p_1} + b_6 e^{p_2} \qquad A_{12} = b_8 e^{p_1} - A_2 b_5 e^{-p_1} - b_6 e^{-p_2}$$

$$A_{13} = b_9 e^{p_1} - A_3 b_5 e^{-p_1} + A' \qquad c_4 = \frac{A_{13}A_8 - A_{10}A_{11}}{A_{11}A_9 - A_8 A_{12}} \qquad c_3 = \frac{A_{13}A_9 - A_{10}A_{12}}{A_{11}A_9 - A_8 A_{12}}$$

$$c_2 = A_1 c_3 + c_4 A_2 + A_3 \qquad c_1 = -c_2 - c_3 - c_4 - A \qquad b_{12} = b_2 - b_4$$

$$b_{13} = b_5(-B_1 - 1) \qquad b_{14} = b_5(B_3 - A) \qquad b_{15} = c_7 b_{13} + c_8 B_2 b_5 + b_{14}$$

$$b_{16} = c_7 b_5 B_1 + c_8 b_5 B_2 + b_5 B_3 \qquad B_1 = \frac{e^{p_1} - \cos p_2}{e^{-p_1} - e^{p_1}} \qquad B_2 = \frac{-\sin p_2}{e^{-p_1} - e^{p_1}}$$

$$B_3 = \frac{Ae^{p_1} - A}{e^{-p_1} - e^{p_1}} \qquad B_4 = -2b_5 B_1 - b_5 \qquad B_5 = -b_2 + b_4$$

$B_6 = -Ab_5 + A_7$

$B_7 = b_{13}e^{p_1} - b_5B_1e^{-p_1} + b_{12}\sin p_2$

$B_8 = b_5e^{p_1}B_2 - b_5B_2e^{-p_1} - b_{12}\cos\ p_2$

$B_9 = b_{14}e^{p_1} - b_5B_3e^{-p_1} + A_6 + A_7$

$c_8 = \frac{B_4B_9 - B_6B_7}{B_5B_7 - B_8B_4}$

$c_7 = \frac{B_5B_9 - B_6B_8}{B_5B_7 - B_8B_4}$

$c_6 = B_1c_7 + c_8B_2 + B_3$

$c_5 = -c_6 - c_7 - A$

$b_{17} = b_1 - b_3$

$b_{18} = (-c_{11} - c_{12} - A)b_{17}$

$b_{19} = b_{17}(-c_{11}B_{11} - c_{12}B_{12} - B_{13})$

$B_{11} = \frac{1-e^{p_2}}{\sin p_1}$

$B_{12} = \frac{1-e^{-p_2}}{\sin p_1}$

$B_{13} = \frac{A(\cos p_1 - 1)}{\sin p_1}$

$B_{14} = -B_{11}b_{17} + b_6$

$B_{15} = -B_{12}b_{17} - b_6$

$B_{16} = -B_{13}b_{17} + A_7$

$B_{17} = (-\sin p_1 - B_{11}\cos p_1)\, b_{17} + b_6e^{p_2}$

$B_{18} = (-\sin p_1 - A_{12}\cos p_1)\, b_{17} - b_6e^{-p_2}$

$B_{19} = (-A\sin p_1 - A_{13}\cos p_1)\, b_{17} + A'$

$c_{12} = \frac{B_{19}B_{15} - B_{16}B_{18}}{B_{14}B_{18} - B_{17}B_{15}}$

$c_{11} = \frac{B_{19}B_{15} - B_{16}B_{18}}{B_{15}B_{17} - B_{18}B_{14}}$

$c_{10} = B_{11}c_{11} + c_{12}B_{12} + B_{13}$

$c_9 = -c_{11} - c_{12} - A$

$H_1 = \frac{cos\ p_1 - cos\ p_2}{\sin p_1}$

$H_2 = \frac{-sin\ p_2}{\sin p_1}$

$H_3 = \frac{Acos\ p_1 - A}{\sin p_1}$

$b_{20} = (-c_{15} - A)b_{17}$

$b_{21} = b_{17}(-c_{15}H_1 - H_3)$

$H_4 = -H_1b_{17}$

$H_5 = H_2b_{17} - b_{12}$

$H_6 = H_3b_5 + A_7$

$H_7 = (-\sin p_1 - H_1\cos p_1)b_{17} + b_{12}\sin p_2$

$H_8 = H_2b_{17}\cos p_1 - b_{12}\cos p_2$

$c_{16} = \frac{H_9H_4 - H_6H_7}{H_5H_7 - H_8H_4}$

$H_9 = -Ab_{17}\sin p_1 - b_{17}H_3\cos p_1 + A'$

$c_{15} = \frac{H_9H_5 - H_6H_8}{H_4H_8 - H_7H_5}$

$c_{14} = H_1c_{15} - c_{16}H_2 + H_3$

$c_{13} = -c_{15} - A$

$I_1 = \frac{e^{q_1} - e^{-q_1}}{e^{q_1}}$

$I_2 = \frac{e^{-q_1}}{e^{q_1}}$

$I_3 = \frac{A(e^{q_1} - 1)}{e^{q_1}}$

$b_{22} = {q_1}^3A_4$

$b_{23} = {q_1}^2A_4$

$b_{24} = q_1A_5$

$b_{25} = b_{22} + b_{24}$

$b_{26} = 3b_{23} + A_5$

$b_{27} = b_{25} + b_{26}$

$b_{28} = b_{25} - b_{26}$

$b'_{29} = c_{19}I_1 - c_{20}I_2 + I_3$

$b_{29} = b_{25}(-c_{19} - A) + b_{26}b'_{29}$

$b_{30} = b_{25}b'_{29}$

$b''_{29} = -b_{25}c_{19} + b_{26}$

$b''_{30} = -c_{20}b_{25}$

$I_4 = -2b_{25} + I_1b_{26}$

$I_5 = -I_2b_{26} + b_{26}$

$I_6 = -Ab_{22} + I_3b_{26} - Ab_{24} + A_7$

$I_7 = -b_{25}(e^{q_1} + e^{-q_1}) + I_1 e^{q_1} b_{27}$

$I_8 = -I_2 e^{q_1} b_{27} - e^{-q_1} b_{28}$

$I_9 = -Ae^{q_1} b_{25} + I_3 e^{q_1} b_{27} + A_6 + A_7$

$c_{20} = \frac{I_9 I_4 - I_6 I_7}{I_5 I_7 - I_8 I_4}$

$c_{19} = \frac{I_9 I_5 - I_6 I_8}{I_4 I_8 - I_7 I_5}$

$c_{18} = I_1 c_{19} - c_{20} I_2 + I_3$

$c_{17} = -c_{19} - A$

$J_1 = -tanq_1$

$J_2 = -tanq_1$

$J_3 = \frac{\mathrm{A}(\cos q_1 - 1)}{\cos q_1}$

$b_{31} = 3b_{23} - A_5$

$b_{32} = b_{22} - b_{24}$

$b_{33} = c_{23} J_1 + c_{24} J_2 + J_3$

$b_{34} = -Ab_{32}$

$b_{35} = b_{32} b_{33}$

$b_{36} = -b_{31} b_{33} - c_{23} b_{32}$

$b_{37} = -c_{24} b_{32}$

$J_4 = -J_1 b_{31} - b_{32}$

$J_5 = -J_2 b_{31}$

$J_6 = -J_3 b_{31} + A_7$

$J_6' = J_1 b_{31} - b_{32}$, $J_7' = J_2 b_{32} - b_{31}$

$J_8' = J_2 b_{31} - b_{32}$

$J_9' = -Ab_{32} + J_3 b_{31}$

$J_7 = \sin q_1 J_1 b_{32} - \cos q_1 J_6'$

$J_8 = \sin q_1 J_7' - \cos q_1 J_8'$

$J_9 = \sin q_1 J_9' - J_3 \cos q_1 \, b_{31} + A'$

$c_{24} = \frac{J_9 J_4 - J_6 J_7}{J_5 J_7 - J_8 J_4}$

$c_{23} = \frac{J_9 J_5 - J_6 J_8}{J_4 J_8 - J_7 J_5}$

$c_{22} = J_1 c_{23} - c_{24} J_2 + J_3$

$c_{21} = -A$

$M_1 = -\tan v_1$

$M_2 = -\tan v_1$

$M_3 = \frac{A(\cos v_1 e^{v_2} - 1)}{\cos v_1 e^{v_2}}$

$b_{38} = {v_2}^2 A_4$

$b_{39} = {v_2}^2 v_1 A_4$

$b_{40} = {v_1}^2 A_4$

$b_{41} = {v_1}^3 A_4$

$b_{42} = v_1 v_2 A_4$

$b_{43} = v_1 {v_2}^3 A_4$

$b_{44} = v_2 {v_1}^2 A_4$

$b_{45} = v_1 A_5$

$b_{46} = v_2 A_5$

$b_{46}' = {v_2}^3 A_4$

$b_{47} = b_{38} - b_{40}$

$b_{48} = 3b_{39} - b_{41}$

$b_{49} = 3b_{44} + b_{46}$

$b_{50} = A(b_{46}' + b_{49})$

$b_{51} = b_{41} - b_{45}$

$b_{52} = 3b_{47} - b_{50} + b_{46}' + A_5$

$b_{53} = -b_{48} - 6b_{42} - b_{45}$

$b_{54} = -b_{51} + 3b_{39}$

$b_{55} = b_{46}' - b_{50}$

$b_{56} = M_1 b_{52} + b_{54}$

$b_{57} = M_1 b_{53} + b_{55}$

$b_{58} = b_{54} + b_{42}$

$b_{59} = b_{55} + 3b_{38} - 2b_{40} + A_5$

$b_{60} = M_2 b_{52} + b_{58}$

$b_{61} = M_2 b_{53} + b_{59}$

$b_{62} = b_{55} + (b_{46}' + A_5)$

$b_{63} = Ab_{50} - Ab_{46}'$

$b_{64} = M_3 b_{62} + b_{63}$

$b_{65} = M_3 b_{53} + Ab_{54}$

$b_{66} = 3b_{47} + A_5$

$b_{67} = 3b_{38} - 2b_{40} + A_5$

$b_{68} = b_{48} + b_{45}$

$b_{69} = M_1 c_{27} + M_2 c_{28} + M_3$

$b_{70} = b_{54} + b_{42} - Ab_{55}$

$b_{71} = b_{55} + b_{67} + Ab_{68}$

$b_{72} = b_{66} b_{69} + b_{70}$

$b_{73} = b_{55}b_{69} + b_{68}$ $b_{74} = -b_{42}b_{69} + b_{71}$ $b_{75} = -b_{68}b_{69} + b_{55}$

$M_4 = (3b_{47} + A_5)M_1 + b_{48} + b_{45}$ $M_5 = (3b_{47} + A_5)M_2 + 6b_{42}$ $M_6 = (3b_{47} + A_5)M_3 - b_{50} + A_7$

$M_7 = (\cos v_1 b_{56} + \sin v_1 b_{57})e^{v_2}$ $M_8 = e^{v_2}(\cos v_1 b_{60} + \sin v_1 b_{61})$ $M_9 = e^{v_2}(\cos v_1 b_{64} + \sin v_1 b_{65})$

$c_{28} = \frac{M_9M_4 - M_6M_7}{M_5M_7 - M_8M_4}$ $c_{27} = \frac{M_9M_5 - M_6M_8}{M_4M_8 - M_7M_5}$ $c_{26} = M_1c_{27} + c_{28}M_2 + M_3$

$c_{25} = -A$ $L_1 = -\tan q_2$ $L_2 = \frac{A(\cos q_2 e^{q_2} - 1)}{\cos q_2 e^{q_2}}$

$b_{77} = {q_2}^3 A_4$ $b_{78} = q_2 A_5$ $b_{79} = -2b_{77} + b_{78}$

$b_{80} = 2b_{77} + b_{78}$ $b_{81} = L_1 b_{79} + L_1 A_5$ $b'_{81} = b_{81} + b_{80}$

$b'_{82} = b_{82} + b_{79}$ $b'_{83} = b'_{81} + 6b_{76}$ $b'_{84} = b'_{82} + A_5$

$b'_{85} = b_{81} - Ab_{79}$ $b'_{86} = b_{82} + Ab_{80}$ $b'_{87} = c_{31} + c_{32}$

$b'_{87} = A(A_5 - b_{79})$ $b'_{88} = -6b'_{87}L_1 - 6A$ $b_{82} = -L_1 b_{80} - 6L_1 b_{76}$

$b_{83} = c_{31}b_{80} + L_1A_5b'_{87} + 6c_{32}b_{76} + b'_{87}$ $b_{84} = -b_{80}b_{81} + b_{79}$ $b_{85} = c_{31}b_{79} - b_{76}b'_{88} + c_{32}A_5L_1$

$L_4 = 2b_{77} + A_5L_1 + b_{79}$ $L_5 = 6b_{76} + A_5L_1$ $L_6 = 2Ab_{77} - Ab_{79} + A_5L_2 + A_7$

$L_7 = (\cos q_2 b'_{81} + \sin q_2 b'_{82})e^{q_2}$ $L_8 = (\cos q_2 b'_{83} + \sin q_2 b'_{84})e^{q_2}$ $L_9 = (\cos q_2 b'_{85} + \sin q_2 b'_{86})e^{q_2} + A'$

$c_{32} = \frac{L_9L_4 - L_6L_7}{L_5L_7 - L_8L_4}$ $c_{31} = \frac{L_9L_5 - L_6L_8}{L_4L_8 - L_7L_5}$ $c_{30} = L_1c_{31} + c_{32}L_1 + L_2$

$c_{29} = -A$ $G_1 = \frac{\cos r - e^r}{e^r - e^{-r}}$ $G_2 = \frac{\sin r}{e^r - e^{-r}}$

$G_3 = \frac{({}^{a_3}/_{2a_1})}{e^r - e^{-r}}$ $b_{86} = r^3 A_4$ $b_{87} = A_5 r$

$b_{88} = b_{86}b_{87}$ $b_{89} = b_{86} - b_{87}$ $b_{90} = -G_1c_{35} - G_2c_{36} + G_3$

$b_{91} = b_{88}b_{90}$ $b_{92} = c_{35}b_{89}$ $b_{93} = c_{36}b_{89}$

$b_{94} = A_6 - \frac{a_3}{a_1}$ $G_4 = (-2G_1 - 1)b_{88}$ $G_5 = -2G_2b_{88} - b_{89}$

$G_6 = 2G_3b_{88} + A_7$ $G_7 = b_{88}(G_1(-e^r - e^{-r}) - e^r) + \sin r\, b_{89}$ $G_8 = b_{88}G_2(-e^r - e^{-r}) + \cos r\, b_{89}$

$G_9 = b_{88}G_3(-e^r - e^{-r}) - \frac{a_3}{a_1} + A'$ $c_{36} = \frac{G_9G_4 - G_6G_7}{G_5G_7 - G_8G_4}$ $c_{35} = \frac{G_9G_5 - G_6G_8}{G_4G_8 - G_7G_5}$

$c_{34} = G_1c_{35} + c_{36}G_2 - G_3$ $c_{33} = -c_{34} - c_{35}$ $b_{95} = \frac{a_3}{6}$

$b_{96} = 3c_{40}$ $b_{97} = 2c_{39} + A_6 + A_4a_3$ $b_{98} = c_{39} + c_{40} + \frac{a_3}{24}$

$b_{99} = 6c_{40}A_4 - b_{98}A_5 + A_7$ $D_1 = -A_5$, $D_2 = -6A_4$

$D_3 = \frac{-25a_3}{24} + A_7$ $D_4 = D_1 + 2$ $D_5 = D_2 + D_1 + 3$

$D_6 = A_4c_{39} - \frac{A_5a_3}{24} + b_{95} + A_6 + A_7$ $c_{40} = \frac{D_6D_1 - D_3D_4}{D_2D_4 - D_5D_1}$ $c_{39} = \frac{D_6D_2 - D_3D_5}{D_1D_5 - D_4D_2}$

$c_{38} = -c_{39} - c_{40} - \frac{a_3}{24}$ $c_{37} = 0$

Chapter 3, Section-I

$a = 1 + \frac{1}{\gamma}$ $b = M^2 + \frac{1}{k}$ $d = apr - 1$

$e = aSc - 1$ $f = \frac{b}{d}$ $g = \frac{b}{e}$

$a_1 = \frac{Gr}{d\,f}$ $a_3 = -\frac{Gr}{d\,f}$ $a_2 = \frac{Gr}{d(1-f)} - \frac{a_1}{1-f} - a_3$

$a_5 = \frac{Gm}{ge^2}$ $a_6 = \frac{Gm}{eg^2}$ $a_4 = \frac{Gm}{e\,(1-g)} - a_5 - \frac{a_6}{1-g}$

Chapter 4, Section-I

$a = 1 + \frac{1}{\gamma}$ $b = M^2 + \frac{1}{k}$ $a_1 = aNr - b$

$a_2 = aPr - 1$ $a_3 = \frac{a_1}{a_2}$ $a_4 = a\,Sc\,Kr - b$

$a_5 = aSc - 1$ $a_6 = \frac{a_4}{a_5}$ $a_7 = \frac{Gr}{a_2\,a_3^2}$

$a_9 = \frac{Gr}{a_2a_3}$ $a_{11} = \frac{Gm}{a_5\,{a_6}^2}$ $a_8 = \frac{Gr}{a_2(1+a_3)} - \frac{a_4}{1+a_3} - a_6$

$a_{12} = \frac{Gm}{a_5a_6}$ $a_{10} = \frac{Gm}{a_5(1+a_6)} - a_8 - \frac{a_9}{1+a_6}$

Chapter 4, Section-II

$a = 1 + \frac{1}{\gamma}$ $b = M^2 + \frac{1}{k}$ $d = \frac{(1+Nr)}{Pr}$

$a_1 = \frac{a}{d} - 1$ $a_2 = \frac{b}{a_1}$ $a_3 = \frac{Gr}{a_1}$

$a_4 = a\,Sc - 1$ $a_5 = a\,Sc\,Kr - b$ $a_6 = \frac{a_5}{a_4}$

$a_7 = \frac{Gm}{a_4}$ $a_8 = -\frac{a_3}{a_2}$ $a_9 = \frac{a_3}{{a_2}^2}$

$a_{11} = \frac{a_7}{a_6}$ $a_{12} = \frac{a_7}{{a_6}^2}$ $a_{10} = \frac{a_3}{(1-a_2)} - a_8 - \frac{a_9}{(1-a_2)}$

$a_{14} = a_{10} + a_{13}$ $a_{15} = a_8 + a_{11}$ $a_{13} = \frac{a_7}{(1+a_6)} - a_{11} - \frac{a_{12}}{(1+a_6)}$

Chapter 5

$a = 1 + \frac{1}{\gamma}$ $b = M^2 + \frac{1}{k}$ $a_1 = a\,Pr - 1$

$a_2 = a\,Pr\,c + b$ $a_3 = \frac{a_2}{a_1}$ $a_4 = \frac{Gr}{a_1}$

$a_5 = a\,Sc - 1$ $a_6 = a\,ScKr - b$ $a_7 = \frac{a_6}{a_5}$

$a_8 = \frac{Gm}{a_5}$ $a_9 = -\frac{a_4}{a_3}$ $a_{10} = \frac{a_4}{{a_3}^2}$

$a_{12} = \frac{a_8}{a_{12}}$ $a_{13} = \frac{a_8}{{a_7}^2}$ $a_{11} = \frac{a_4}{(1-a_3)} - a_9 - \frac{a_{10}}{(1-a_3)}$

$a_{16} = a_9 + a_{12}$ $a_{15} = a_{11} + a_{14}$ $a_{14} = \frac{a_8}{(1+a_7)} - a_{12} - \frac{a_{13}}{(1+a_7)}$

Chapter 6, Section-I

$a = 1 + \frac{1}{\gamma}$ $b = M^2 + \frac{1}{k}$ $\mathrm{c} = \mathrm{Gr}$

$\mathrm{d} = \mathrm{Gm}$ $a_6 = \frac{1}{Pr}$ $a_7 = \frac{H-R}{Pr}$

$a_8 = \frac{1}{Sc}$ $a_9 = Sr$ $a_{10} = Kr$

$a_{11} = \frac{a_8}{a_6}$ $a_{12} = \frac{a_7}{a_6}$ $a_{13} = a_{10} - a_{12}$

$b_{14} = a_{11} - 1$ $a_{14} = \frac{a_9}{a_6}$ $a_{15} = \frac{a_{13}}{b_{14}}$

$a_{16} = \frac{a_{14}}{b_{14}}$ $a_{17} = \frac{-a_{16}\,a_7}{a_{15}}$ $a_{18} = \frac{-a_{16}\,(a_{15}+a_7)}{{a_{15}}^2}$

$a_{20} = \frac{a}{a_6}$ $a_{21} = \frac{a.\ a_7}{a_6}$ $a_{19} = \frac{a_{16}\,(1-a_7)}{1+a_{15}} - a_{17} - \frac{a_{18}}{1+a_{15}}$

$b_{21} = a_{20} - 1$ $a_{22} = \ b + a_{21}$ $a_{23} = \frac{a_{22}}{b_{21}}$

$a_{24} = \frac{c}{b_{21}}$ $b_{24} = \frac{a}{a_8} - 1$ $a_{25} = \frac{a\,a_{10}}{a_8} + b$

$$a_{26} = \frac{a_{25}}{b_{24}} \qquad a_{27} = \frac{d}{b_{24}} \qquad a_{28} = \frac{d\, a_{16}}{b_{24}}$$

$$a_{29} = \frac{d\, a_{16}}{b_{21}} \qquad a_{30} = \frac{-a_{24}}{a_{23}} \qquad a_{31} = \frac{a_{24}}{{a_{23}}^2}$$

$$a_{33} = \frac{-a_{27}}{a_{26}} \qquad a_{34} = \frac{a_{27}}{{a_{26}}^2} \qquad a_{32} = \frac{a_{24}}{1-a_{23}} - a_{30} - \frac{a_{31}}{1-a_{23}}$$

$$a_{36} = \frac{a_{28}\, a_7}{a_{15}\, a_{26}} \qquad a_{37} = \frac{a_{28}\,(a_7 + a_{15})}{{a_{15}}^2(\, a_{26} + a_{15})} \qquad a_{35} = \frac{a_{27}}{1-a_{26}} - a_{33} - \frac{a_{34}}{1-a_{26}}$$

$$a_{38} = \frac{a_{28}\,(a_{26} - a_7)}{{a_{26}}^2(\, a_{26} + a_{15})} \qquad a_{40} = \frac{a_{29}\, a_7}{a_{15}\, a_{23}} \qquad a_{39} = \frac{a_{28}(1-a_7)}{(1-a_{26})(1+a_{15})} - a_{36} - \frac{a_{37}}{1+a_{15}} - \frac{a_{38}}{1-a_{26}}$$

$$a_{41} = \frac{a_{29}\,(a_7 + a_{15})}{{a_{15}}^2(\, a_{23} + a_{15})} \qquad a_{42} = \frac{a_{29}\,(a_{23} - a_7)}{{a_{23}}^2(\, a_{23} + a_{15})} \qquad a_{43} = \frac{a_{29}(1-a_7)}{(1-a_{23})(1+a_{15})} - a_{40} - \frac{a_{41}}{1+a_{15}} - \frac{a_{42}}{1-a_{23}}$$

$$a_{46} = a_{31} - a_{42} \qquad a_{47} = a_{35} + a_{38} \qquad a_{44} = a_{32} + a_{35} + a_{39} - a_{43}$$

$$a_{48} = a_{37} - a_{41} \qquad a_{49} = a_{43} - a_{32} \qquad a_{45} = a_{30} + a_{33} + a_{36} - a_{40}$$

$$a_{50} = a_{40} - a_{30} \qquad a_{51} = a_{42} - a_{31} \qquad a_{52} = -a_{35} - a_{39}$$

$$a_{53} = -a_{33} - a_{36} \qquad a_{54} = -a_{34} - a_{38} \qquad a_{55} = \frac{-a_{28}\,(a_{15} + a_7)}{a_{15}(\, a_{26} + a_{15})}$$

$$a_{56} = \frac{a_{28}\,(a_{26} - a_7)}{a_{26}(\, a_{26} + a_{15})} \qquad a_{57} = \frac{-a_{29}\,(a_{15} + a_7)}{a_{15}(\, a_{23} + a_{15})} \qquad a_{58} = \frac{a_{29}\,(a_{23} - a_7)}{a_{23}(\, a_{23} + a_{15})}$$

$$a_{59} = a_{30} + a_{36} - a_{40} \qquad a_{60} = -a_{30} - a_{58} \qquad a_{61} = a_{55} - a_{57}$$

$$a_{62} = a_{30} + a_{58} \qquad a_{63} = \frac{a_{16}\,(a_{15} + a_7)}{a_{15}} \qquad a_{64} = a_{33} - a_{56}$$

$$F_1(y,s) = \frac{e^{-y\sqrt{\frac{s+b}{a}}}}{s+iw} \qquad F_2(y,s) = \frac{e^{-y\sqrt{\frac{s+b}{a}}}}{s-iw} \qquad F_3(y,s) = \frac{e^{-y\sqrt{\frac{s+b}{a}}}}{s}$$

$$F_4(y,s) = \frac{e^{-y\sqrt{\frac{s+b}{a}}}}{s^2} \qquad F_5(y,s) = \frac{e^{-y\sqrt{\frac{s+b}{a}}}}{s-a_{23}} \qquad F_6(y,s) = \frac{e^{-y\sqrt{\frac{s+b}{a}}}}{(s-a_{26})}$$

$$F_7(y,s) = \frac{e^{-y\sqrt{\frac{s+b}{a}}}}{(s+a_{15})} \qquad F_8(y,s) = \frac{e^{-y\sqrt{\frac{s-a_7}{a_6}}}}{s} \qquad F_9(y,s) = \frac{e^{-y\sqrt{\frac{s-a_7}{a_6}}}}{s^2}$$

$$F_{10}(y,s) = \frac{e^{-y\sqrt{\frac{s-a_7}{a_6}}}}{(s-a_{23})} \qquad F_{11}(y,s) = \frac{e^{-y\sqrt{\frac{s-a_7}{a_6}}}}{(s+a_{15})} \qquad F_{12}(y,s) = \frac{1}{s} e^{-y\sqrt{\frac{s-a_{10}}{a_8}}}$$

$F_{13}(y,s) = \frac{1}{s^2} e^{-y\sqrt{\frac{s-a_{10}}{a_8}}}$ $F_{14}(y,s) = \frac{e^{-y\sqrt{\frac{s-a_{10}}{a_8}}}}{(s-a_{26})}$ $F_{15}(y,s) = \frac{e^{-y\sqrt{\frac{s-a_{10}}{a_8}}}}{(s+a_{15})}$

$f_i(y,t) = L^{-1}F_i(y,s)\,, i = 1\ to\ 15$ $h_i(y,t) = L^{-1}H_i(y,s)\,, i = 1\ to\ 3$ $g_i(y,t) = L^{-1}G_i(y,s)\,, i = 1\ to\ 15$

$h_1 = g_2 + g_3 + g_4$ $h_2 = f_{13} + g_{10} + g_{11}$ $h_3 = g_1 + g_7 + g_{14} + g_{15}$

$g_1 = \frac{i}{2} f_1 - \frac{i}{2} f_2$ $g_6 = a_{35}f_3 + a_{33}f_4 + a_{34}f_6$ $g_2 = a_{44}f_3 + a_{45}f_4 + a_{46}f_5 + a_{47}f_6 + a_{48}f_7$

$g_{11} = a_{19}f_8 + a_{17}f_9 + a_8 f_{11}$ $g_5 = a_{59}f_3 + a_{60}f_5 + a_{61}f_7 + a_{56}f_6$ $g_3 = a_{49}f_8 + a_{50}f_9 + a_{51}f_{10} + a_{41}f_{11}$

$g_{12} = a_{17}f_{12} + a_{63}f_{15}$ $g_7 = a_{50}f_8 + a_{62}f_{10} + a_{57}f_{11}$ $g_4 = a_{52}f_{12} + a_{53}f_{13} + a_{54}f_{14} - a_{37}f_{15}$

$g_{13} = a_{17}f_8 + a_{63}f_{11}$ $g_8 = a_{35}f_{12} + a_{33}f_{13} + a_{34}f_{14}$ $g_9 = a_{36}f_{12} + a_{55}f_{15} + a_{56}f_{14}$

$g_{15} = a_{53}f_{12} - a_{55}f_{15} - a_{64}f_{14}$ $g_{10} = a_{19}f_{12} + a_{17}f_{13} + a_8 f_{15}$ $g_{14} = a_{45}f_3 + a_{60}f_5 + a_{64}f_6 + a_{61}f_7$

$J_1 = \left.\frac{df_1}{dy}\right|_{y=0}$ …….$J_{15} = \left.\frac{df_{13}}{dy}\right|_{y=0}$ $J_{16} = \left.\frac{dg_1}{dy}\right|_{y=0}$ …$J_{30} = \left.\frac{dg_{15}}{dy}\right|_{y=0}$ $J_{31} = \left.\frac{dh_1}{dy}\right|_{y=0}$ … …$J_{33} = \left.\frac{dh_3}{dy}\right|_{y=0}$

$$L^{-1}\left(\frac{e^{-y\sqrt{s+b}}}{s}\right) = \frac{1}{2}\left[e^{-y\sqrt{b}}\ erfc\ \left(\frac{y}{2\sqrt{t}} - \sqrt{bt}\right) + e^{y\sqrt{b}}\ erfc\ \left(\frac{y}{2\sqrt{t}} + \sqrt{bt}\right)\right]$$

$$L^{-1}\left(\frac{e^{-y\sqrt{s+b}}}{s^2}\right) = \frac{1}{2}\left[\left(t - \frac{y}{2\sqrt{b}}\right)e^{-y\sqrt{b}}\ erfc\ \left(\frac{y}{2\sqrt{t}} - \sqrt{bt}\right) + \left(t + \frac{y}{2\sqrt{b}}\right)e^{y\sqrt{b}}\ erfc\ \left(\frac{y}{2\sqrt{t}} + \sqrt{bt}\right)\right]$$

$$L^{-1}\left(\frac{e^{-y\sqrt{s+b}}}{(s+a)}\right) = \frac{e^{-at}}{2}\left[e^{-y\sqrt{\frac{1}{a}(b-a)}}\ erfc\ \left(\frac{y}{2\sqrt{t}} - \sqrt{(b-a)t}\right) + e^{y\sqrt{\frac{1}{a}(b-a)}}\ erfc\ \left(\frac{y}{2\sqrt{t}} + \sqrt{(b-a)t}\right)\right]$$

Chapter 6, Section-II

$c = 1 + \frac{\alpha}{k_1}$ $b = M^2 + \frac{1}{k_1}$ $a_1 = \frac{-H}{1+R}\,,\ L = \frac{\mathrm{Pr}}{1+R}$

$a_2 = a_1 - Kr.Sc$ $a_3 = \mathrm{L} - Sc$ $a_4 = \frac{a_2}{a_3}$

$a_5 = \frac{Sr.Sc}{a_3}$ $a_6 = \frac{a_1\, a_5}{a_4}$ $a_7 = \frac{a_5\,(a_1 - a_4\,L)}{{a_4}^2}$

$$a_{10} = \frac{Gm}{b_9\,(b_9 - b_{10})} \qquad a_9 = \frac{Gm}{b_9\,b_{10}} \qquad a_8 = \frac{a_5\,(a_1 + L)}{1 + a_4} - a_6 - \frac{a_7}{1 + a_4}$$

$$a_{11} = \frac{Gm}{b_{10}\,(b_{10} - b_9)} \qquad a_{12} = \frac{Gm\,a_1\,a_5}{a_4\,b_9\,b_{10}} \qquad a_{13} = \frac{Gm\,a_5(a_1 - a_4\,L)}{(-a_4)\,(b_9 + a_4)(a_4 + b_{10})}$$

$$a_{14} = \frac{Gm\,a_5(a_1 + b_9\,L)}{(b_9)\,(b_9 + a_4)(b_9 - b_{10})} \qquad a_{16} = \frac{Gr}{b_4\,b_5} \qquad a_{15} = \frac{Gm\,a_5(a_1 + b_{10}\,L)}{(b_{10})\,(b_{10} + a_4)(b_{10} - b_9)}$$

$$a_{17} = \frac{Gr}{(b_4)(b_4 - b_5)} \qquad a_{18} = \frac{Gr}{(b_5)(b_5 - b_4)} \qquad a_{21} = \frac{Gm\,a_5(a_1 + b_4\,L)}{(b_4)\,(b_4 + a_4)(b_4 - b_5)}$$

$$a_{20} = \frac{Gm\,a_5(a_1 - a_4\,L)}{(-a_4)\,(b_4 + a_4)(a_4 + b_5)} \qquad a_{19} = \frac{Gm\,a_1\,a_5}{a_4\,b_4\,b_5} \qquad a_{22} = \frac{Gm\,a_5(a_1 + b_5\,L)}{(b_5)\,(b_5 + a_4)(b_5 - b_4)}$$

$$a_{23} = a_9 + a_{12} \qquad a_{24} = a_{10} + a_{14} \qquad a_{25} = a_{11} + a_{15}$$

$$a_{26} = a_{16} - a_{19} \qquad a_{27} = a_{17} - a_{21} \qquad a_{28} = a_{18} - a_{22}$$

$$a_{29} = \frac{Gr}{(b_4 - b_5)} \qquad a_{30} = \frac{Gm\,a_5(a_1 - a_4\,L)}{(b_9 + a_4)(a_4 + b_{10})} \qquad a_{31} = \frac{Gm\,a_5(a_1 + b_9\,L)}{(b_9 + a_4)(b_9 - b_{10})}$$

$$a_{32} = \frac{Gm\,a_5(a_1 + b_{10}\,L)}{(b_{10} + a_4)(b_{10} - b_9)} \qquad a_{33} = \frac{Gm\,a_5(a_1 - a_4\,L)}{(b_4 + a_4)(a_4 + b_5)} \qquad a_{34} = \frac{Gm\,a_5(a_1 \mp b_4\,L)}{(b_4 + a_4)(b_4 - b_5)}$$

$$a_{35} = \frac{Gm\,a_5(a_1 \mp b_5\,L)}{(b_5 + a_4)(b_5 - b_4)} \qquad a_{36} = a_{29} - a_{34} \qquad a_{37} = -a_{29} - a_{35}$$

$$a_{38} = \frac{a_5(a_1 - a_4\,L)}{(-a_4)} \qquad b_1 = \alpha\,L \qquad b_2 = L + \alpha\,a_1 - c$$

$$b_3 = a_1 - b \qquad b_4 = \frac{-b_2 + \sqrt{b_2^2 - 4b_1b_3}}{2b_1} \qquad b_5 = \frac{-b_2 - \sqrt{b_2^2 - 4b_1b_3}}{2b_1}$$

$$b_6 = \alpha\,Sc \qquad b_7 = Sc + \alpha\,kr\,Sc - c \qquad b_8 = Kr\,Sc - b$$

$$b_9 = \frac{-b_7 + \sqrt{b_7^2 - 4b_6b_8}}{2b_6} \qquad b_{10} = \frac{-b_7 - \sqrt{b_7^2 - 4b_6b_8}}{2b_6}$$

Chapter 7, Section-I

$$a = 1 + \frac{1}{\gamma} \qquad a_2 = \frac{1 + Nr}{Pr} \qquad a_1 = \frac{M^2(1 - im)}{1 + m^2} + \frac{1}{k} - 2ik_1{}^2$$

$$a_3 = \frac{1}{Sc} \qquad a_4 = \frac{a}{a_2} - 1 \qquad a_8 = \frac{a}{a_3} - 1$$

$$a_6 = \frac{a_5}{a_4} \qquad a_7 = \frac{Gr}{a_4} \qquad a_9 = \frac{a\,Kr}{a_3} - a_1$$

$$a_{10} = \frac{a_9}{a_8} \qquad a_{11} = \frac{Gm}{a_8} \qquad a_{14} = \frac{a_7}{(1 - a_6)} - a_{12} - \frac{a_{13}}{(1 - a_6)}$$

$a_{12} = -\frac{a_7}{a_6}$ $a_{13} = \frac{a_7}{{a_6}^2}$ $a_{17} = \frac{a_{11}}{(1+a_{10})} - a_{15} - \frac{a_{16}}{(1+a_{10})}$

$a_{15} = \frac{a_{11}}{a_{10}}$ $a_{16} = \frac{a_{11}}{{a_{10}}^2}$

Chapter 7, Section-II

$a = 1 + \frac{1}{\gamma}$ $c = \frac{(1+R)}{Pr}$ $b = \frac{M^2(1-im)}{1+m^2} + \frac{1}{k_1} - 2ik^2$

$d = \frac{H}{pr}$ $a_1 = \frac{Sr.Sc}{c}$ $a_2 = \frac{1}{c} - Sc$

$a_3 = \frac{d}{c} + Kr.Sc$ $a_4 = \frac{a_3}{a_2}$ $a_5 = -\frac{a_1}{a_2}$

$a_6 = \frac{a}{c} - 1$ $a_7 = \frac{a\,d}{c} + b$ $a_8 = \frac{a_7}{a_6}$

$a_9 = \frac{Gr}{a_6}$ $a_{10} = aSc - 1$ $a_{11} = Sc\ Kr\ a - b$