In[●]:= `z2 := a * Exp[-I * c1 * t] + b`

In[●]:= `z3 := r * Exp[-I * c1 * t] + g`

In[●]:= `z20 := A * Exp[I * c1 * t] + B`

In[●]:= `z30 := R * Exp[I * c1 * t] + G`

In[●]:= `pz2 := I * a * c1 * Exp[-I * c1 * t] - I * b * c1`

In[●]:= `pz3 := I * r * c1 * Exp[-I * c1 * t] - I * g * c1`

In[●]:= `Pz2 := -I * A * c1 * Exp[I * c1 * t] + I * B * c1`

In[●]:= `Pz3 := -I * R * c1 * Exp[I * c1 * t] + I * G * c1`

In[●]:= `deqn := 2 * c0 - (c1 / 2) * (z2 * z20 + z3 * z30) - (I / 4) * (z2 * Pz2) +`
`(I / 4) * (z20 * pz2) - (I / 4) * (z3 * Pz3) + (I / 4) * (z30 * pz3)`

In[●]:= `deqn`

Out[●]= $2\,c0 + \frac{1}{4}\,i\,\left(-i\,b\,c1 + i\,a\,c1\,e^{-i\,c1\,t}\right)\left(B + A\,e^{i\,c1\,t}\right) - \frac{1}{4}\,i\,\left(b + a\,e^{-i\,c1\,t}\right)\left(i\,B\,c1 - i\,A\,c1\,e^{i\,c1\,t}\right) +$

$\frac{1}{4}\,i\,\left(-i\,c1\,g + i\,c1\,e^{-i\,c1\,t}\,r\right)\left(G + e^{i\,c1\,t}\,R\right) - \frac{1}{4}\,i\,\left(g + e^{-i\,c1\,t}\,r\right)\left(i\,c1\,G - i\,c1\,e^{i\,c1\,t}\,R\right) -$

$\frac{1}{2}\,c1\,\left(\left(b + a\,e^{-i\,c1\,t}\right)\left(B + A\,e^{i\,c1\,t}\right) + \left(g + e^{-i\,c1\,t}\,r\right)\left(G + e^{i\,c1\,t}\,R\right)\right)$

In[●]:= `Simplify[%10]`

Out[●]= $2\,c0 - \frac{1}{2}\,c1\,e^{-i\,c1\,t}\,\left(A\,b\,e^{2\,i\,c1\,t} + a\,\left(B + 2\,A\,e^{i\,c1\,t}\right) + G\,r + e^{2\,i\,c1\,t}\,g\,R + 2\,e^{i\,c1\,t}\,r\,R\right)$

In[●]:= `Expand`$\left[2\,c0 - \frac{1}{2}\,c1\,e^{-i\,c1\,t}\,\left(A\,b\,e^{2\,i\,c1\,t} + a\,\left(B + 2\,A\,e^{i\,c1\,t}\right) + G\,r + e^{2\,i\,c1\,t}\,g\,R + 2\,e^{i\,c1\,t}\,r\,R\right)\right]$

Out[●]= $2\,c0 - a\,A\,c1 - \frac{1}{2}\,a\,B\,c1\,e^{-i\,c1\,t} - \frac{1}{2}\,A\,b\,c1\,e^{i\,c1\,t} - \frac{1}{2}\,c1\,e^{-i\,c1\,t}\,G\,r - \frac{1}{2}\,c1\,e^{i\,c1\,t}\,g\,R - c1\,r\,R$

In[●]:= `DSolve`$\left[y'[t] == 2\,c0 - a\,A\,c1 - \frac{1}{2}\,a\,B\,c1\,e^{-i\,c1\,t} - \right.$

$\left. \frac{1}{2}\,A\,b\,c1\,e^{i\,c1\,t} - \frac{1}{2}\,c1\,e^{-i\,c1\,t}\,G\,r - \frac{1}{2}\,c1\,e^{i\,c1\,t}\,g\,R - c1\,r\,R,\ y[t],\ t\right]$

Out[●]= $\left\{\left\{y[t] \to -\frac{1}{2}\,i\,e^{-i\,c1\,t}\,\left(a\,B + G\,r\right) + \frac{1}{2}\,i\,e^{i\,c1\,t}\,\left(A\,b + g\,R\right) + 2\,c0\,t - c1\,\left(a\,A + r\,R\right)\,t + C[1]\right\}\right\}$

In[●]:= $-\frac{1}{2}\,i\,e^{-i\,c1\,t}\,\left(a\,B + G\,r\right) + \frac{1}{2}\,i\,e^{i\,c1\,t}\,\left(A\,b + g\,R\right) + 2\,c0\,t - c1\,\left(a\,A + r\,R\right)\,t + C[1]$

Out[●]= $-\frac{1}{2}\,i\,e^{-i\,c1\,t}\,\left(a\,B + G\,r\right) + \frac{1}{2}\,i\,e^{i\,c1\,t}\,\left(A\,b + g\,R\right) + 2\,c0\,t - c1\,\left(a\,A + r\,R\right)\,t + C[1]$

In[●]:= `Expand`$\left[-\frac{1}{2}\,i\,e^{-i\,c1\,t}\,\left(a\,B + G\,r\right) + \frac{1}{2}\,i\,e^{i\,c1\,t}\,\left(A\,b + g\,R\right) + 2\,c0\,t - c1\,\left(a\,A + r\,R\right)\,t + C[1]\right]$

Out[●]= $-\frac{1}{2}\,i\,a\,B\,e^{-i\,c1\,t} + \frac{1}{2}\,i\,A\,b\,e^{i\,c1\,t} - \frac{1}{2}\,i\,e^{-i\,c1\,t}\,G\,r + \frac{1}{2}\,i\,e^{i\,c1\,t}\,g\,R + 2\,c0\,t - a\,A\,c1\,t - c1\,r\,R\,t + C[1]$

In[•]:= $\mathbf{y1} := -\dfrac{1}{2}\, i\, a\, B\, e^{-i\, c1\, t} + \dfrac{1}{2}\, i\, A\, b\, e^{i\, c1\, t} -$
$\dfrac{1}{2}\, i\, e^{-i\, c1\, t}\, G\, r + \dfrac{1}{2}\, i\, e^{i\, c1\, t}\, g\, R + 2\, c0\, t - a\, A\, c1\, t - c1\, r\, R\, t + \text{CONSTANT}$

In[•]:= $\mathbf{z2 * z20 + z3 * z30}$

Out[•]= $\left(b + a\, e^{-i\, c1\, t}\right)\left(B + A\, e^{i\, c1\, t}\right) + \left(g + e^{-i\, c1\, t}\, r\right)\left(G + e^{i\, c1\, t}\, R\right)$

In[•]:= $\textbf{Expand}\left[\left(b + a\, e^{-i\, c1\, t}\right)\left(B + A\, e^{i\, c1\, t}\right) + \left(g + e^{-i\, c1\, t}\, r\right)\left(G + e^{i\, c1\, t}\, R\right)\right]$

Out[•]= $a\, A + b\, B + a\, B\, e^{-i\, c1\, t} + A\, b\, e^{i\, c1\, t} + g\, G + e^{-i\, c1\, t}\, G\, r + e^{i\, c1\, t}\, g\, R + r\, R$

In[•]:= $\left(a\, A + b\, B + a\, B\, e^{-i\, c1\, t} + A\, b\, e^{i\, c1\, t} + g\, G + e^{-i\, c1\, t}\, G\, r + e^{i\, c1\, t}\, g\, R + r\, R\right) / 2$

Out[•]= $\dfrac{1}{2}\left(a\, A + b\, B + a\, B\, e^{-i\, c1\, t} + A\, b\, e^{i\, c1\, t} + g\, G + e^{-i\, c1\, t}\, G\, r + e^{i\, c1\, t}\, g\, R + r\, R\right)$

In[•]:= $\textbf{Expand}\left[\dfrac{1}{2}\left(a\, A + b\, B + a\, B\, e^{-i\, c1\, t} + A\, b\, e^{i\, c1\, t} + g\, G + e^{-i\, c1\, t}\, G\, r + e^{i\, c1\, t}\, g\, R + r\, R\right)\right]$

Out[•]= $\dfrac{a\, A}{2} + \dfrac{b\, B}{2} + \dfrac{1}{2}\, a\, B\, e^{-i\, c1\, t} + \dfrac{1}{2}\, A\, b\, e^{i\, c1\, t} + \dfrac{g\, G}{2} + \dfrac{1}{2}\, e^{-i\, c1\, t}\, G\, r + \dfrac{1}{2}\, e^{i\, c1\, t}\, g\, R + \dfrac{r\, R}{2}$

In[•]:= $\mathbf{x1} := \dfrac{a\, A}{2} + \dfrac{b\, B}{2} + \dfrac{1}{2}\, a\, B\, e^{-i\, c1\, t} + \dfrac{1}{2}\, A\, b\, e^{i\, c1\, t} + \dfrac{g\, G}{2} + \dfrac{1}{2}\, e^{-i\, c1\, t}\, G\, r + \dfrac{1}{2}\, e^{i\, c1\, t}\, g\, R + \dfrac{r\, R}{2}$