Constructing Term Structure -- Nelson-Siegel

Equal Weighted

In[93]:= $\alpha = 1;$

In[94]:= $R[t\_, \beta0\_, \beta1\_, \beta2\_] := \beta0 + \beta1 * \dfrac{1 - e^{-\alpha*t}}{\alpha * t} + \beta2 * \dfrac{1 - (1 + \alpha * t) * e^{-\alpha * t}}{\alpha * t};$

In[95]:= $B[t\_, \beta0\_, \beta1\_, \beta2\_] := e^{-t*R[t,\beta0,\beta1,\beta2]};$

In[96]:= $Cp[t\_, c\_, \beta0\_, \beta1\_, \beta2\_] := 0.5 * \sum_{i=1}^{2*t} c * e^{-(i/2)*R[i/2,\beta0,\beta1,\beta2]} + e^{-t*R[t,\beta0,\beta1,\beta2]};$

In[97]:= $\{b0, b1, b2\} = \{\beta0, \beta1, \beta2\} /. \text{Minimize}\big[$
$(1 - Cp[1, 0.54 / 100, \beta0, \beta1, \beta2])^2 +$
$(1 - Cp[2, 0.85 / 100, \beta0, \beta1, \beta2])^2 +$
$(1 - Cp[5, 1.59 / 100, \beta0, \beta1, \beta2])^2 +$
$(1 - Cp[10, 2.22 / 100, \beta0, \beta1, \beta2])^2, \{\beta0, \beta1, \beta2\}\big][[2]]$

Out[97]= $\{0.0292219, -0.0131588, -0.0538798\}$

Duration weighted

In[98]:= $Dur[t\_, c\_, \beta0\_, \beta1\_, \beta2\_] :=$
$\sum_{i=1}^{2*t} \dfrac{0.5 * c * (i/2) * e^{-(i/2)*R[i/2,\beta0,\beta1,\beta2]}}{Cp[t, c, \beta0, \beta1, \beta2]} + \dfrac{1 * t * e^{-t*R[t,\beta0,\beta1,\beta2]}}{Cp[t, c, \beta0, \beta1, \beta2]};$

In[99]:=

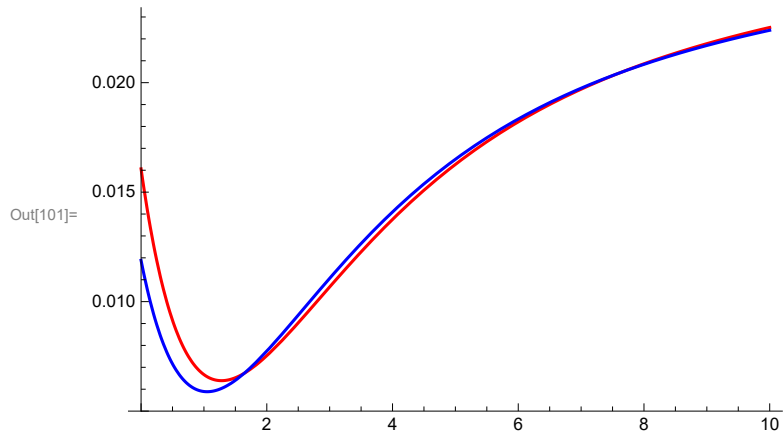In[100]:= $\{B0, B1, B2\} = \{\beta0, \beta1, \beta2\} /. \text{Minimize}\big[$
$(1 / Dur[1, 0.54/100, \beta0, \beta1, \beta2]) * (1 - Cp[1, 0.54 / 100, \beta0, \beta1, \beta2])^2 +$
$(1 / Dur[2, 0.85/100, \beta0, \beta1, \beta2]) * (1 - Cp[2, 0.85 / 100, \beta0, \beta1, \beta2])^2 +$
$(1 / Dur[5, 1.59/100, \beta0, \beta1, \beta2]) * (1 - Cp[5, 1.59 / 100, \beta0, \beta1, \beta2])^2 +$
$(1 / Dur[10, 2.22/100, \beta0, \beta1, \beta2]) *$
$(1 - Cp[10, 2.22 / 100, \beta0, \beta1, \beta2])^2, \{\beta0, \beta1, \beta2\}\big][[2]]$

Out[100]= $\{0.0286729, -0.016788, -0.046042\}$

Plot

In[101]:= `Plot[{R[t, b0, b1, b2], R[t, B0, B1, B2]}, {t, 0, 10}, PlotStyle → {Red, Blue}]`

Out[101]=

In[102]:=

In[103]:= `ClearAll`

Out[103]= ClearAll