Mathematical model for quarter car with passive suspension

The model is derived by applying Newton's Second Law to the two masses. In ordinary differential equations, the model is:

$$
\begin{aligned}
f(t) &= c\,v_s(t) - c\,v_u(t) + k\,y_s(t) - k\,y_u(t) && (1)\\
h(t) &= f(t) - k_t\,y_u(t) + k_t\,y_r(t) && (2)\\
\frac{dy_s(t)}{dt} &= v_s(t) && (3)\\
\frac{dy_u(t)}{dt} &= v_u(t) && (4)\\
\frac{dv_s(t)}{dt} &= \frac{1}{m_s\,m_u + (m_s + m_u)\,b}(-(m_u + b)\,f(t) + b\,h(t)) && (5)\\
\frac{dv_u(t)}{dt} &= \frac{1}{m_s\,m_u + (m_s + m_u)\,b}(-b\,f(t) + (m_s + b)\,h(t)) && (6)
\end{aligned}
$$

After applying Euler's forward method, the equations become the following.

Equations (7)-(12) are what you need for simulation.

$$
\begin{aligned}
f(t) &= c\,v_s(t) - c\,v_u(t) + k\,y_s(t) - k\,y_u(t) && (7)\\
h(t) &= f(t) - k_t\,y_u(t) + k_t\,y_r(t) && (8)\\
y_s(t+\Delta) &= y_s(t) + v_s(t)\,\Delta && (9)\\
y_u(t+\Delta) &= y_u(t) + v_u(t)\,\Delta && (10)\\
v_s(t+\Delta) &= v_s(t) + \left[\frac{(-(m_u + b)\,f(t) + b\,h(t))}{m_s\,m_u + (m_s + m_u)\,b}\right]\Delta && (11)\\
v_u(t+\Delta) &= v_u(t) + \left[\frac{(-b\,f(t) + (m_s + b)\,h(t))}{m_s\,m_u + (m_s + m_u)\,b}\right]\Delta && (12)
\end{aligned}
$$