Dynamic Estimation of Motion

Minimize the squared errors between the predicted position (x_1) and the measured position (y_1) by manipulating acceleration (u). Find the optimal sequence of acceleration moves to minimize the objective function. Use the following optimization problem statement and data.

$$\min_u \int_0^{t_f} (x_1(t) - y_1(t))^2$$

$$s.t. \quad \frac{dx_1(t)}{dt} = x_2(t)$$

$$\frac{dx_2(t)}{dt} = u(t)$$

$$x(0) = [0, 1]$$

time	y1
0	0
0.001	0.1
0.05	0.2
0.1	0.4
0.15	0.8
0.2	1.6
0.25	3.2
0.3	6.4
0.35	12.8
0.4	25.6
0.45	51.2
0.5	100
0.55	90
0.6	80
0.65	70
0.7	60
0.75	50
0.8	50
0.85	50
0.9	50
0.95	50
1	55
1.05	60.5
1.1	66.55
1.15	73.205
1.2	80.5255
1.25	88.57805
1.3	97.43586
1.35	100
1.4	100
1.45	100
1.5	100
1.55	100
1.6	100
1.65	100
1.7	100
1.75	100
1.8	100
1.85	100
1.9	100
1.95	100
2	100