

ECE 133A HW 1

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Exercise T8.8

For a specific t_i we have

$$\begin{aligned}f(t_i) &= y_i \\ \frac{c_1 + c_2 t_i + c_3 t_i^2}{1 + d_1 t_i + d_2 t_i^2} &= y_i \\ c_1 + c_2 t_i + c_3 t_i^2 &= y_i (1 + d_1 t_i + d_2 t_i^2) \\ c_1 + c_2 t_i + c_3 t_i^2 - y_i d_1 t_i - y_i d_2 t_i^2 &= y_i\end{aligned}$$

Therefore we can construct a matrix A and a vector b , such that $A\theta = b$, where $\theta = [c_1, c_2, c_3, d_1, d_2]^T$. We have that for 5 values of t_i and the corresponding 5 values of y_i ,

$$A = \begin{bmatrix} 1 & t_1 & t_1^2 & -y_1 t_1 & -y_1 t_1^2 \\ 1 & t_2 & t_2^2 & -y_2 t_2 & -y_2 t_2^2 \\ 1 & t_3 & t_3^2 & -y_3 t_3 & -y_3 t_3^2 \\ 1 & t_4 & t_4^2 & -y_4 t_4 & -y_4 t_4^2 \\ 1 & t_5 & t_5^2 & -y_5 t_5 & -y_5 t_5^2 \end{bmatrix}$$

and

$$B = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \end{bmatrix}$$

Therefore we can then just solve for θ with $\theta = A^{-1}b$.

Thus for the values of t and y given, we can get the values of θ with the following code:

```
t=[1,2,3,4,5]
y=[-1,12,10,1,-3]
A=zeros(5,5)
for i=1:5
    A[i,:]=[1,t[i],t[i]^2,-y[i]*t[i],-y[i]*t[i]^2]
end
print("theta= ")
println(round.(A\y,digits=3))
```

We get that

$$\theta = \boxed{(-6.117, 6.99, -1.322, -0.709, 0.158)}$$