University of Portland
School of Engineering

EE 262
Spring 2018
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Homework # 7—MATLAB
(Assigned: Monday, April 16, 2018)
(Due: Friday, April 27, 2018, 9:15a.m.)

Inan MATLAB Problem # 1: Sketching a continuous-time signal.

Example # 1: Plotting $x = 3\sin(2t)$.
MATLAB commands for Example # 1:

```
>>syms t
>>x = 3*sin(2*t);
>>ezplot x or ezplot(x, [–3,3])
```

Problem # 1: Plot these continuous-time signals:
(a) $f(t) = 2\cos(3t)$; (b) $3u(t-2)$; (c) $5[u(t) - 3u(t-1) + 2u(t-4)]$; (d) $4r(t-1)$

Inan MATLAB Problem # 2: Taking derivative of a continuous-time signal.
Example # 2a: Derivative of $f(t) = 4\cos(2t^3)$.
MATLAB commands for Example # 2a:

```
>>syms f(t)
>>f(t) = 4*cos(2*t^3);
>>df = diff(f,t)
```

Example # 2b: Second derivative of $f(t) = 4\cos(2t^3)$.
MATLAB commands for Example # 2b:

```
>>syms f(t)
>>f(t) = 4*cos(2*t^3);
>>df2= diff(f,t,2)
```

Problem # 2: Find the first derivatives of the following signals:
(a) $4\sin(5(t-3)^2)$; (b) $3e^{\cos(2t)}u(t)$; (c) $3u(t-2)$; (d) $3(t-2)u(t-2)$; (e) $(2t+3)^2\cos tu(t)$

Inan MATLAB Problem # 3: Integration of a continuous-time signal.
Example # 3a: Integral of $f(t) = 6\sin(2t)$.
MATLAB commands for Example # 3a:

```
>>syms t
>>f(t) = 6*sin(2*t);
>>int(f)
```

Example # 3b: Evaluate $\int \frac{2t}{\left(1+t^2\right)^2} dt$.

MATLAB commands for Example # 3b:

```
>>syms t
>>f(t)  = 2*t/(1+t^2)^2;
>>int(f)
```

Example # 3c: Evaluate $\int_{-2\pi/3}^{\pi/4} 4\cos(2t)dt$.

MATLAB commands for Example # 3c:

```
>>syms t
>>f(t)  = 4*cos(2*t);
>>int(f,  –2*pi/3, pi/4) or int(f, t, –2*pi/3, pi/4)
```

Problem # 3: Evaluate the following integrals:

(a) $\int 6\sec^2(3t)dt$; (b) $\int_{-\infty}^{t} \delta(\tau)d\tau$; (c) $\int_1^e \frac{dt}{t}$; (d) $\int_{-3}^{4} 2u(t)dt$; (e) $\int_{-\infty}^{\infty} \delta(t)dt$;

(f) $\int_2^{\infty} \delta(t-1)dt$; (g) $\int_{-\infty}^{\infty} \delta(3t)dt$; (h) $\int_{-\infty}^{\infty} t^2\delta(t-3)dt$; (i) $\int_{-2}^{5} tu(t)dt$

Inan MATLAB Problem # 4: Solving a differential equation.

Example # 4a: Solve the differential equation $\frac{dy(t)}{dt} = ay(t)$.

MATLAB commands for Example # 4a:

```
>>syms a y(t)
>>eqn = diff(y,t) == a*y;
>>dsolve(eqn)
```

Example # 4b: Solve the differential equation $d^2y(t)/dt^2 = 9y(t)$.

MATLAB commands for Example # 4b:

```
>>syms y(t)
>>eqn = diff(y,t,2) == 9*y;
>>ySol(t) = dsolve(eqn)
```

Example # 4c: Solve the ordinary differential equation $dy(t)/dt + 3y(t) = 2e^{-t}$ under the initial condition $y(0) = 2$.

MATLAB commands for Example # 4c:

```
>>syms y(t)
>>ode = diff(y) + 3*y == 2*exp(-t);
>>cond = y(0) == 2;
ySol(t) = dsolve(ode,cond)
```

Example # 4d: Solve the differential equation $d^2y(t)/dt^2 + 4dy(t)/dt + 3y(t) = 2e^{-t}$ under the initial conditions $y(0) = 2$ and $y'(0) = -1$.

MATLAB commands for Example # 4d:

```
>> syms y(t)
>> eqn = diff(y,t,2) + 4*diff(y,t) + 3*y == 2*exp(-t);
>> Dy = diff(y,t);
>> cond = [y(0) == 2, Dy(0) == –1];
>> ySol(t) = dsolve(eqn,cond)
```

Problem # 4: Solve the following differential equations:

(a) $dy/dt + 2y = 10$ under $y(0) = 2$;

(b) $dy/dt + 4y = 3e^{-t}$ under $y(0) = -1$

Inan MATLAB Problem # 5: Laplace transform of a signal.

Example # 5a: Take the Laplace transform of $x(t) = 3u(t-2) + 4\delta(t-1)$.

MATLAB commands for Example # 5a:

```
>>syms t s
>>x = 3*heaviside(t – 2) + 4*dirac(t – 1);
>>laplace(x,t,s)
```

Example # 5b: Take the Laplace transform of $x = 4e^{-3t}u(t)$.

MATLAB commands for Example # 5b:

```
>>syms t s
>>x = 4*exp(–3*t)*heaviside(t);
>>laplace(x,t,s)
```

Problem # 5: Take the Laplace transform of the following signals:

(a) $x = 2\delta(t-\pi) - 4tu(t-1)$; (b) $x = 3te^{-2t}u(t)$; (c) $x = 5e^{-2t}\cos(4t)u(t)$

Inan MATLAB Problem # 6: Inverse Laplace transform of a signal.

Example # 6a: Take the inverse Laplace transform of $F(s) = \dfrac{4e^{-s}}{(s+3)}$.

MATLAB commands for Example # 6a:

```
>>syms t s
>>F = 4*exp(–s)/(s+3);
>>ilaplace(F,s,t)
```

Example # 6b: Take the inverse Laplace transform of $X(s) = \dfrac{s+5}{s^2+3s+2}$.

MATLAB commands for Example # 6b:

```
>>syms t s
>>X = (s+5)/(s^2+3*s+2);
>>ilaplace(X,s,t)
```

Problem # 6: Take the inverse Laplace transform of the following signals:

(a) $X(s) = 3e^{-4s}$; (b) $X(s) = \dfrac{s+11}{s^2+7s+10}$; (c) $X(s) = \dfrac{5s+3}{s^2+2s+1}$; (d) $X(s) = \dfrac{6e^{-2s}}{s^2+9}$

More to come…

Please use the following guidelines for your homework solutions:

1) On the first sheet, at the top center, write: Homework #7-Solutions.
2) Provide your full name on the upper right corner of the first sheet.
3) Also write: EE 262/Spring 2018 on the upper left corner of the first sheet.
4) Solve each problem on a separate sheet unless your solution is very short.
5) Box all of your answers.
6) Staple your solutions in the above order before you turn them in.

Please turn in your homework on time.