

## Example code for nonlinear case ( problem 1 of HW2)

Find the solution of the following nonlinear equation,

$$\dot{x} = \begin{bmatrix} x_2 \\ (x_3 - \sin x_1 - x_2) / J \\ -x_3 - x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$\text{where, } x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}; \quad x(0) = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

**% in main program =====**

```
options = odeset('RelTol',1e-6,'AbsTol',[1e-6 1e-6 1e-6]);
```

```
U=[time, uff];
```

```
[t, state]=ode45('findx_n',[0 8],[0 0 0],options,1,U);
```

```
% note: time and t are different
```

**% this function is saved as 'findx\_n'=====**

```
function xdiff= fun(t, x_n, flag, J, U)
```

```
time = U(:,1);
```

```
uff = U(:,2);
```

```
u = interp1(time, uff, t);
```

```
xdiff=zeros(3,1);
```

```
xdiff(1)=x_n(2);
```

```
xdiff(2)=(x_n(3)-sin(x_n(1))-x_n(2))/J;
```

```
xdiff(3)=-x_n(3)-x_n(2)+u;
```

```
return
```