

```
function dy=swingup_12_eq12(t, y, Vin, ca, cp, mp, r, lp, Jb, Ra, Km, Ke, Jm, n, g);
```

```
%---2006.7.26-----
```

```
%%% nonlinear System
```

```
global MD
```

```
%---definition---
```

```
%-----
%
%アーム角度 振子角度 アーム角速度 振子角速度 アーム角加速度 振子角加速度 電圧
%---y(1,1) y(2,1) y(3,1) y(4,1) u
%
% dy(1,1) dy(2,1) dy(3,1) dy(4,1)
%-----
```

```
dy=zeros(4,1);
```

```
Kti=n*Km/Ra;
```

```
cti=ca + n^2*Ke*Km/Ra;
```

```
u2=Kti*Vin - cti*y(3,1);
```

```
md11=Jb + mp*r^2 + mp*lp^2*(sin(y(2,1)))^2 + Jm*n^2;% mp*lp^2
```

```
md12=mp*r*lp*cos(y(2,1));
```

```
md21=mp*r*lp*cos(y(2,1));
```

```
md22=mp*lp^2 + lp;
```

```
hd1=(mp*lp^2*y(4,1)*sin(2*y(2,1)))*y(3,1) - (mp*r*lp*y(4,1)*sin(y(2,1)))*y(4,1);
```

```
hd2=(-mp*lp^2*y(3,1)*sin(y(2,1))*cos(y(2,1)))*y(3,1);
```

```
gd1=0;
```

```
gd2=-mp*g*lp*sin(y(2,1));
```

```
MD=[ md11 md12 ; md21 md22];
```

```
minv=inv([ md11 md12 ; md21 md22]);
```

```
dy(1,1)=y(3,1);
```

```
dy(2,1)=y(4,1);
```

```
dy(3,1)= -minv(1,1)*hd1 - minv(1,2)*hd2 - minv(1,1)*gd1 - minv(1,2)*gd2 + minv(1,1)*u2 - minv(1,2)*cp*y(4,1);
```

```
dy(4,1)= -minv(2,1)*hd1 - minv(2,2)*hd2 - minv(2,1)*gd1 - minv(2,2)*gd2 + minv(2,1)*u2 - minv(2,2)*cp*y(4,1);
```