

```

t = solution.phase.time;
EQsol = solution.phase.state;
control = solution.phase.control;

% please remove comment below, if you are using this code, after the code of minimum wind shear
% beta = solution.parameter;
beta = 0.2;
options = odeset('RelTol',1e-10,'AbsTol',1e-10);

m = length(t);
period = t(m,1); % selected by GPOPS for given nodes

N = 6; %states
K = 0.045;
H = 1.2*4.19/(2*81.7);

CLpp = spline(t,control(:,1));
mupp = spline(t,control(:,2));
xpp = spline(t,EQsol(:,1));
ypp = spline(t,EQsol(:,2));
zpp = spline(t,EQsol(:,3));
vpp = spline(t,EQsol(:,4));
gamapp = spline(t,EQsol(:,5));
psipp = spline(t,EQsol(:,6));

CL = @(t) (ppval(CLpp,t));
mu = @(t) (ppval(mupp,t));
x = @(t) (ppval(xpp,t));
y = @(t) (ppval(ypp,t));
z = @(t) (ppval(zpp,t));
v = @(t) (ppval(vpp,t));
gamma = @(t) (ppval(gamapp,t));
psi = @(t) (ppval(psipp,t));

g = 9.81;
Cd0 = 0.00873;

Pertder = @(t) [0,0,beta,cos(gamma(t)).*sin(psi(t)),(-1).*sin(gamma(t)).*sin(psi(t)).*v(t),...
cos(gamma(t)).*cos(psi(t)).*v(t);0,0,0,cos(gamma(t)).*...
cos(psi(t)),(-1).*cos(psi(t)).*sin(gamma(t)).*v(t),(-1).*...
cos(gamma(t)).*sin(psi(t)).*v(t);0,0,0,sin(gamma(t)),cos(gamma(t)).*v(t)...
,0;0,0,0,(-1).*beta.*cos(gamma(t)).*sin(gamma(t)).*sin(psi(t))+...
(-2).*H.*(Cd0+CL(t)).^2.*K).*v(t),(-1).*g.*cos(gamma(t))+(-1).*beta.*...
cos(gamma(t)).^2.*sin(psi(t)).*v(t)+beta.*sin(gamma(t)).^2.*sin(psi(t))....
*v(t),(-1).*beta.*cos(gamma(t)).*cos(psi(t)).*sin(gamma(t))...
.*v(t);0,0,0,CL(t).*H.*cos(mu(t))+g.*cos(gamma(t)).*v(t).^(-2),2.*...
beta.*cos(gamma(t)).*sin(gamma(t)).*sin(psi(t))+g.*sin(gamma(t)).*...
v(t).^(-1),beta.*cos(psi(t)).*sin(gamma(t)).^2;0,0,0,CL(t).*H.*sec(gamma(t))...
.*sin(mu(t)),(-1).*beta.*cos(psi(t))+sec(gamma(t)).*tan(gamma(t))...

```

```
.*((-1).*beta.*cos(psi(t)).*sin(gamma(t))+CL(t).*H.*sin(mu(t))....  
.*v(t)),beta.*sin(psi(t)).*tan(gamma(t))];  
  
odeLinDS = @(tau,xstate) (Pertder(tau)*(xstate));  
  
initial = eye(N);  
FTM = zeros(N);  
  
for i = 1:N  
[T,X] = ode45(odeLinDS,0:period/4:period,initial(:,i),options);  
FTM(:,i) = X(end,:);  
end  
  
[V,D] = eig(FTM);  
freq = (1/period).*angle(diag(D))  
damp = (1/period).*log(abs(diag(D)))
```