```
function [ydot] = NumericJ2Prop(t,Y,mu, J2, Re)
% J2 IS 7th TERM IN STATE!!!!!
% the input Y is a column with the beginning being the states and the end
% being the STM
%--- propagate the state
ydot = zeros(6,1);
ydot(1:3,1) = Y(4:6,1);
rmag = norm(Y(1:3,1));

apertx = -((mu*Y(1,1))/(norm(Y(1:3,1)))^3)*(1-J2*(3/2)*(Re/norm(Y(1:3,1)))^2*(5*(Y(3,1)/norm(Y(1:3,1)))^2-1));
aperty = -((mu*Y(2,1))/(norm(Y(1:3,1)))^3)*(1-J2*(3/2)*(Re/norm(Y(1:3,1)))^2*(5*(Y(3,1)/norm(Y(1:3,1)))^2-1));
apertz = -((mu*Y(3,1))/(norm(Y(1:3,1)))^3)*(1-J2*(3/2)*(Re/norm(Y(1:3,1)))^2*(5*(Y(3,1)/norm(Y(1:3,1)))^2-3));

J2partial = 0;


ydot(4) = apertx;
ydot(5) = aperty;
ydot(6) = apertz;

if length(Y) == 7
    ydot(7) = J2partial;
else
    % do nothing
end

% If only wanting to propagate state then dont worry about this part
if length(Y) < 8
    % No worries, just propagating the state
else
    % going to propagate the STM too
    %--- construct A matrix to be evaluated for each new state
    x = Y(1);
    y = Y(2);
    z = Y(3);

    % this was evaluated previously and put in here
    A(1,1) = (mu*(12*J2*Re^2*x^4 + 9*J2*Re^2*x^2*y^2 - 81*J2*Re^2*x^2*z^2 - 3*J2*Re^2*y^4 + 9*J2*Re^2*y^2*z^2 + 12*J2*Re^2*z^4 + 4*x^6 + 6*x^4*y^2 + 6*x^4*z^2 - 2*y

    A(2,1) = (3*mu*x*y*(5*J2*Re^2*x^2 + 5*J2*Re^2*y^2 - 30*J2*Re^2*z^2 + 2*x^4 + 4*x^2*y^2 + 4*x^2*z^2 + 2*y^4 + 4*y^2*z^2 + 2*z^4))/(2*(x^2 + y^2 + z^2)^(9/2));%-(

    A(3,1) = (3*mu*x*z*(15*J2*Re^2*x^2 + 15*J2*Re^2*y^2 - 20*J2*Re^2*z^2 + 2*x^4 + 4*x^2*y^2 + 4*x^2*z^2 + 2*y^4 + 4*y^2*z^2 + 2*z^4))/(2*(x^2 + y^2 + z^2)^(9/2));%

    A(1,2) = (3*mu*x*y*(5*J2*Re^2*x^2 + 5*J2*Re^2*y^2 - 30*J2*Re^2*z^2 + 2*x^4 + 4*x^2*y^2 + 4*x^2*z^2 + 2*y^4 + 4*y^2*z^2 + 2*z^4))/(2*(x^2 + y^2 + z^2)^(9/2));%-(

    A(2,2) = (mu*(-3*J2*Re^2*x^4 + 9*J2*Re^2*x^2*y^2 + 9*J2*Re^2*x^2*z^2 + 12*J2*Re^2*y^4 - 81*J2*Re^2*y^2*z^2 + 12*J2*Re^2*z^4 - 2*x^6 - 6*x^4*z^2 + 6*x^2*y^4 - 6*

    A(3,2) = (3*mu*y*z*(15*J2*Re^2*x^2 + 15*J2*Re^2*y^2 - 20*J2*Re^2*z^2 + 2*x^4 + 4*x^2*y^2 + 4*x^2*z^2 + 2*y^4 + 4*y^2*z^2 + 2*z^4))/(2*(x^2 + y^2 + z^2)^(9/2));

    A(1,3) = (3*mu*x*z*(15*J2*Re^2*x^2 + 15*J2*Re^2*y^2 - 20*J2*Re^2*z^2 + 2*x^4 + 4*x^2*y^2 + 4*x^2*z^2 + 2*y^4 + 4*y^2*z^2 + 2*z^4))/(2*(x^2 + y^2 + z^2)^(9/2));

    A(2,3) = (3*mu*y*z*(15*J2*Re^2*x^2 + 15*J2*Re^2*y^2 - 20*J2*Re^2*z^2 + 2*x^4 + 4*x^2*y^2 + 4*x^2*z^2 + 2*y^4 + 4*y^2*z^2 + 2*z^4))/(2*(x^2 + y^2 + z^2)^(9/2));

    A(3,3) = -(mu*(9*J2*Re^2*x^4 + 18*J2*Re^2*x^2*y^2 - 72*J2*Re^2*x^2*z^2 + 9*J2*Re^2*y^4 - 72*J2*Re^2*y^2*z^2 + 24*J2*Re^2*z^4 + 2*x^6 + 6*x^4*y^2 + 6*x^2*y^4 - 6

    Afull = [zeros(3,3), eye(3,3), zeros(3,1); ...
        A, zeros(3,3), zeros(3,1);...
        zeros(1,7)];

    % Phi is the end of the Y column vector
    phiCol = Y(8:end);

    % reshape to be matrix
    phi = reshape(phiCol, [7,7]);

    % STM propagation
    phiDot = Afull * phi;


    % The state is the first part and phi is the second
    ydot(8:56) = reshape(phiDot, [49, 1]);

end

end
```

```
Not enough input arguments.

Error in Utility.NumericJ2Prop (line 7)
ydot(1:3,1) = Y(4:6,1);
```

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