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```
clear;  
clc;  
close all;
```

## define parameters

---

```
omega = 2;  
alpha = 1;
```

## A(t)

---

```
A = @(t) [0, 1; -(omega - alpha * cos(2*t)), 0];
```

## ODE: $\Phi_{\dot{}}$ = A \* $\Phi$

---

```
odefun = @(t, X) reshape(A(t) * reshape(X, 2, 2), 4, 1);  
X0 = reshape(eye(2), 4, 1);  
  
% for initial condition t0=0 and t0=1  
tspan_0 = [0 3*pi];  
tspan_1 = [1 1 + 3*pi];  
  
% solve ODE  
[t_0, X_0] = ode45(odefun, tspan_0, X0);  
[t_1, X_1] = ode45(odefun, tspan_1, X0);  
  
% solution(4x1) to  $\Phi$ (2x2)  
 $\Phi_{t_0_0}$  = zeros(length(t_0), 2, 2);  
 $\Phi_{t_0_1}$  = zeros(length(t_1), 2, 2);  
  
for i = 1:length(t_0)  
     $\Phi_{t_0_0}(i, :, :) = \text{reshape}(X_0(i, :), 2, 2);$   
end  
for i = 1:length(t_1)  
     $\Phi_{t_0_1}(i, :, :) = \text{reshape}(X_1(i, :), 2, 2);$   
end
```

## print answer

---

```

disp('on the time interval of length equal to three periods of oscillations for t0 = 0');
Phi_t0_0_end = reshape(Phi_t_t0_0(end, :, :), 2, 2);
disp(Phi_t0_0_end);

disp('on the time interval of length equal to three periods of oscillations for t0 = 1');
Phi_t0_1_end = reshape(Phi_t_t0_1(end, :, :), 2, 2);
disp(Phi_t0_1_end);

```

```

on the time interval of length equal to three periods of oscillations for t0 = 0
    0.942135130380487    0.378508906373619
   -0.297404112355399    0.942171885496012

on the time interval of length equal to three periods of oscillations for t0 = 1
    1.086870981799333    0.244552932093098
   -0.546381236772937    0.797533945490601

```

## plot just for checking

```

figure;
subplot(2,2,1);
plot(t_0, squeeze(Phi_t_t0_0(:,1,1)), 'DisplayName', 't_0 = 0');
hold on;
plot(t_1, squeeze(Phi_t_t0_1(:,1,1)), 'DisplayName', 't_0 = 1');
xlabel('Time t');
ylabel('\Phi_{11}(t)');
legend;
title('State transition matrix element \Phi_{11}(t)');

subplot(2,2,2);
plot(t_0, squeeze(Phi_t_t0_0(:,1,2)), 'DisplayName', 't_0 = 0');
hold on;
plot(t_1, squeeze(Phi_t_t0_1(:,1,2)), 'DisplayName', 't_0 = 1');
xlabel('Time t');
ylabel('\Phi_{12}(t)');
legend;
title('State transition matrix element \Phi_{12}(t)');

subplot(2,2,3);
plot(t_0, squeeze(Phi_t_t0_0(:,2,1)), 'DisplayName', 't_0 = 0');
hold on;
plot(t_1, squeeze(Phi_t_t0_1(:,2,1)), 'DisplayName', 't_0 = 1');
xlabel('Time t');
ylabel('\Phi_{21}(t)');
legend;
title('State transition matrix element \Phi_{21}(t)');

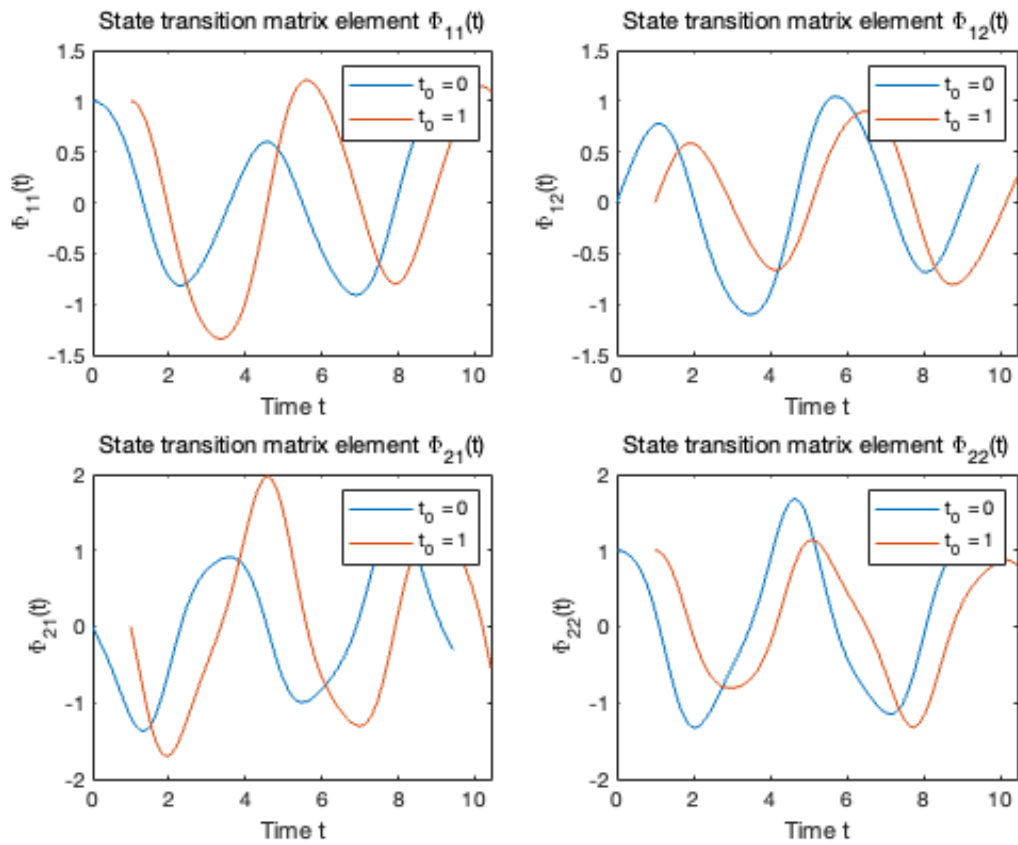
subplot(2,2,4);
plot(t_0, squeeze(Phi_t_t0_0(:,2,2)), 'DisplayName', 't_0 = 0');
hold on;
plot(t_1, squeeze(Phi_t_t0_1(:,2,2)), 'DisplayName', 't_0 = 1');
xlabel('Time t');
ylabel('\Phi_{22}(t)');

```

```

legend;
title('State transition matrix element \Phi_{22}(t)');

```



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