

# Ramp Calculation

```
clear
close
```

## Inputs

```
V_max = 200;
X_end = 5000;
A_max = 20;
Jerk = 10;
Te=1e-2; % interpolation time
```

## Funktionen

```
% Jerk
j = @(J) J
```

```
j = function_handle with value:
    @(J)J
```

```
% Beschleunigung
a = @(a_0, J, t) a_0 + J * t
```

```
a = function_handle with value:
    @(a_0,J,t)a_0+J*t
```

```
% Geschwindigkeit
v = @(v_0, a_0, J, t) v_0 + a_0 * t + 1/2 * J * t.^2
```

```
v = function_handle with value:
    @(v_0,a_0,J,t)v_0+a_0*t+1/2*J*t.^2
```

```
% Position
x = @(x_0, v_0, a_0, J, t) x_0 + v_0 * t + 1/2 * a_0 * t.^2 + 1/6 * J * t.^3
```

```
x = function_handle with value:
    @(x_0,v_0,a_0,J,t)x_0+v_0*t+1/2*a_0*t.^2+1/6*J*t.^3
```

```
% Zeit während Jerk
a1_0 = 0;
v1_0 = 0;
x1_0 = 0;
```

```
if Jerk > 0
    T_j_1 = A_max/Jerk;
else
    T_j_1 = 0;
end
```

```
t(1) = 0;
t(2) = T_j_1;
t1 = t(1):Te:t(2);
x_jerk_1 = vpa(x(x1_0, v1_0, a1_0, Jerk, t1));
v_jerk_1 = v(v1_0, a1_0, Jerk, t1);
a_jerk_1 = vpa(a(a1_0, Jerk, t1));
j_jerk_1 = Jerk + zeros(1,length(t1));
```

```
% Zeit volle Beschleunigung
x2_0 = x_jerk_1(length(x_jerk_1));
v2_0 = v_jerk_1(length(v_jerk_1));
a2_0 = A_max;
```

```
T_a_1 = (V_max - 2 * v_jerk_1(length(v_jerk_1)))/A_max;
t(3) = T_a_1;
t2 = t(1):Te:t(3);
```

```
x_acceleration_1 = x(x2_0, v2_0, a2_0, 0, t2);
v_acceleration_1 = v(v2_0, a2_0, 0, t2);
a_acceleration_1 = a(a2_0, 0, t2);
j_acceleration_1 = 0 + zeros(1,length(t2));
```

```
% Zeit Jerk2
x3_0 = x_acceleration_1(length(x_acceleration_1));
v3_0 = v_acceleration_1(length(v_acceleration_1));
```

```

a3_0 = A_max;

T_j_2 = T_j_1;
x_jerk_2 = x(x3_0, v3_0, a3_0, -Jerk, t1);
v_jerk_2 = v(v3_0, a3_0, -Jerk, t1);
a_jerk_2 = a(a3_0, -Jerk, t1);
j_jerk_2 = -Jerk + zeros(1,length(t1));

% Zeit volle Geschwindigkeit
x4_0 = x_jerk_2(length(x_jerk_2));
v4_0 = v_jerk_2(length(v_jerk_2));
a4_0 = vpa(a_jerk_2(length(a_jerk_2)));
T_v = (X_end - 2 * x4_0)/V_max;
t(4) = T_v;
t3 = t(1):Te:t(4);
x_fullspeed = x(x4_0, v4_0, 0, 0, t3);
v_fullspeed = v(v4_0, 0, 0, t3);
a_fullspeed = a(0, 0, t3);
j_fullspeed = 0 + zeros(1,length(t3));

% Zeit Jerk3
x5_0 = x_fullspeed(length(x_fullspeed));
v5_0 = v_fullspeed(length(v_fullspeed));
a5_0 = 0;

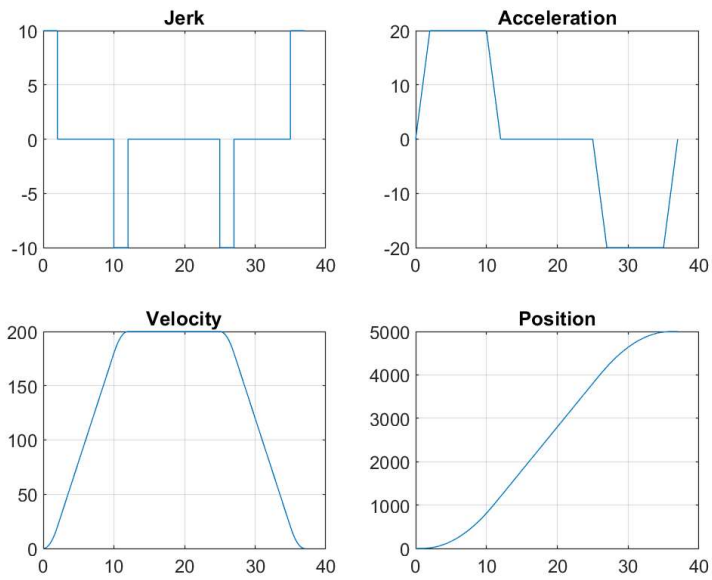
T_j_3 = T_j_2;
x_jerk_3 = x(x5_0, v5_0, a5_0, -Jerk, t1);
v_jerk_3 = v(v5_0, a5_0, -Jerk, t1);
a_jerk_3 = a(a5_0, -Jerk, t1);
j_jerk_3 = -Jerk + zeros(1,length(t1));

% Zeit Entschleunigen
x6_0 = x_jerk_3(length(x_jerk_3));
v6_0 = v_jerk_3(length(v_jerk_3));
a6_0 = -A_max;
T_a_2 = T_a_1;
x_acceleration_2 = x(x6_0, v6_0, a6_0, 0, t2);
v_acceleration_2 = v(v6_0, a6_0, 0, t2);
a_acceleration_2 = a(a6_0, 0, t2);
j_acceleration_2 = -0 + zeros(1,length(t2));

% Zeit Jerk4
x7_0 = x_acceleration_2(length(x_acceleration_2));
v7_0 = v_acceleration_2(length(v_acceleration_2));
a7_0 = -A_max;
T_j_4 = T_j_3;
x_jerk_4 = x(x7_0, v7_0, a7_0, Jerk, t1);
v_jerk_4 = v(v7_0, a7_0, Jerk, t1);
a_jerk_4 = a(a7_0, Jerk, t1);
j_jerk_4 = Jerk + zeros(1,length(t1));

T_out = [t1, t(2)+t2, t(2)+t(3)+t1, 2*t(2)+t(3)+t3, 2*t(2)+t(3)+t(4)+t1, 3*t(2)+t(3)+t(4)+t2, 3*t(2)+2*t(3)+t(4)+t1];
J_out = [j_jerk_1,j_acceleration_1,j_jerk_2,j_fullspeed,j_jerk_3,j_acceleration_2,j_jerk_4];
A_out = [a_jerk_1,a_acceleration_1,a_jerk_2,a_fullspeed,a_jerk_3,a_acceleration_2,a_jerk_4];
V_out = [v_jerk_1,v_acceleration_1,v_jerk_2,v_fullspeed,v_jerk_3,v_acceleration_2,v_jerk_4];
X_out = [x_jerk_1,x_acceleration_1,x_jerk_2,x_fullspeed,x_jerk_3,x_acceleration_2,x_jerk_4];
figure();
subplot(2,2,1)
plot(T_out,J_out);
title('Jerk');
grid;
subplot(2,2,2)
plot(T_out,A_out);
title('Acceleration');
grid;
subplot(2,2,3)
plot(T_out,V_out);
title('Velocity');
grid;
subplot(2,2,4)
plot(T_out,X_out);
title('Position');
grid;

```



```
% Totale Zeit
T = 4 * T_j_1 + 2 * T_a_1 + T_v
```

```
T = 37.0
```

```
if X_end <= (T_a_1 + 2 * T_j_1) * V_max % Triangular velocity profile
    T_v = 0;
    T_j_1 = 0;
    T_a_1 = sqrt(X_end / A_max);
end
```