

A MATLAB PROGRAM TO GENERATE CAM PROFILES

This program called 'camplot.m' was made in Matlab to generate cam profiles for given up-stroke and down-stroke conditions.

This program supports many types of motions such as uniform motion, cyclic motion and simple harmonic motion.

The program also supports multiple types of motion for a single stroke – for example, the first half of an upstroke can be uniform motion and the second half can be cyclic motion.

The user only needs to input the stroke information in this format -

<disp> <motion type> in <angle from reference>

For example, 30 SHM in 90

will create a stroke from current location to 30 units displacement from the base circle in 90 degrees.

The program automatically detects if given information refers to upstroke or downstroke depending on previous data.

Explanation and source code.

Some program default values are taken -

```
base = input('Enter base circle radius : ');
```

```
y_prev = base; %in units of length
```

```
d_prev = 0; %in units of angle
```

```
d_next = 0;
```

```
figure;
```

A while loop is used till the data upto 360 degrees are entered -

```
while d_next ~= 2*pi
```

Here, information of one stroke is taken. The input is in form of strings and it is split into words to read the sentence using regexp. Variable seg is in cell form and is converted into string or double as appropriate. Temporary variables are then deleted. The resolution, that is the number of divisions in a stroke is taken as 20. It can be modified as required.

```
segstr = input('Enter segment ', 's');
```

```
seg = regexp(segstr, ' ', 'split');
```

```
y_next = double(string(seg(1))) + base;
```

```
motion_type = string(seg(2));
```

```
d_next = deg2rad((double(string(seg(4)))));
```

```
clear segstr seg;
```

```
res = 20;
```

Based on the motion type, rest of the decisions are taken -
switch motion_type

Here, subplot(1,2,1) is the displacement plot and subplot(1,2,2) is the actual camprofile. Both will appear in same window as subplot is used. A stroke path is created by connecting previously entered data d_prev and y_prev to d_next and y_next.

```
case 'uni'
    subplot(1,2,1);
    plot(rad2deg(linspace(d_prev,d_next,res)), -base +
    linspace(y_prev,y_next,res));
    hold on;
    subplot(1,2,2);
    polarplot(linspace(d_prev,d_next,res), linspace(y_prev,y_next,res));
    hold on;
```

Similarly, other motions are implemented. The equations of motions for SHM and Cyclic motions can be found in “Theory of Machines by Ratan”.

```
case 'shm'
    subplot(1,2,1);
    plot(rad2deg(linspace(d_prev,d_next,res)), y_prev-base+((y_next-y_prev)/2).*(1-
    cos(pi*linspace(0,1,res))));
    hold on;
```

```
subplot(1,2,2);
polarplot(linspace(d_prev,d_next,res), y_prev+((y_next-y_prev)/2).*(1-
cos(pi*linspace(0,1,res))));
hold on;
```

```
case 'cyl'
h = y_next - y_prev;
al = linspace(0,1,res);
subplot(1,2,1);
plot(rad2deg(linspace(d_prev,d_next,res)), -base+y_prev+ (h/pi)*(pi.*al
- .5*sin(2*pi.*al)));
hold on;
```

```
subplot(1,2,2);
polarplot(linspace(d_prev,d_next,res), y_prev+ (h/pi)*(pi.*al - .5*sin(2*pi.*al)));
hold on;
otherwise
    disp('Unsupported type');
    continue;
```

Finally the base circle is generated as reference -

```
hold on;  
subplot(1,2,2);  
hold on;  
polarplot(linspace(0,2*pi,60),base*ones(60,1));  
d_prev = d_next;  
y_prev = y_next;  
end
```

Future improvement pathways -

- 1) Support for more types of motions and followers
- 2) Automatic animation of cam and follower motion
- 3) Velocity graph, Acceleration graph and Jerk graphs.
- 4) Instant export to popular CAD software – just enter the stroke information and a CAD model will be automatically generated for the given cam profile.
- 5) Support for oscillation type followers.

Example 1

Generate a camprofile of base radius 30 units. The upstroke is from 0 to 90 degrees in simple harmonic motion. The Dwell is from 90 degrees to 150 degrees. The downstroke is from 150 to 270 degrees in cyclic motion. Maximum displacement is 20 units.

What user has to input is marked in bold -

Enter base circle radius : 30

Enter segment : **20 shm in 90**

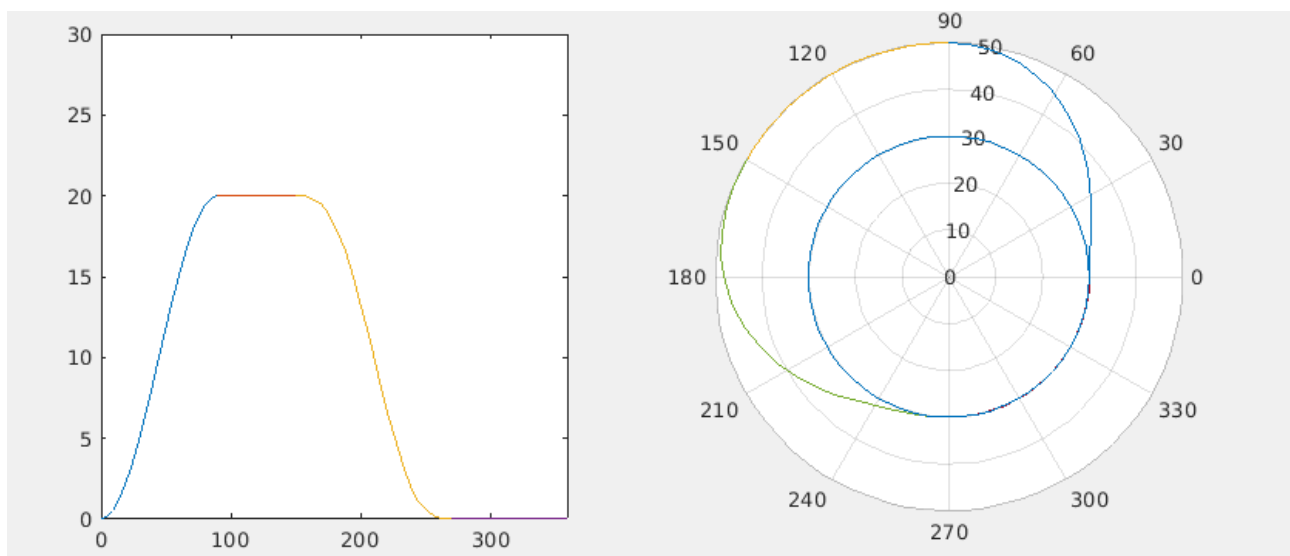
Enter segment : **20 uni in 150**

Enter segment : **0 cyl in 270**

Enter segment : **0 uni in 360**

The cam profile is then generated instantly. Note that by convention in Matlab 0 degrees is in right hand side and this represents clockwise rotation. This will be customizable in a future update.

Different colours represents different strokes. The left is the displacement plot and right is the cam profile.



Example 2

Generate a camprofile as follows -

Upstroke – till 90 degrees. Half should be uniform motion and rest simple harmonic motion.

Dwell – 90 to 130 degrees.

Downstroke – till 270 degrees. Till 170 degrees it should be cyclic and rest should be uniform motion.

As before, user input is given in bold :

Enter base circle radius : **30**

Enter segment : **10 uni in 45**

Enter segment : **20 shm in 90**

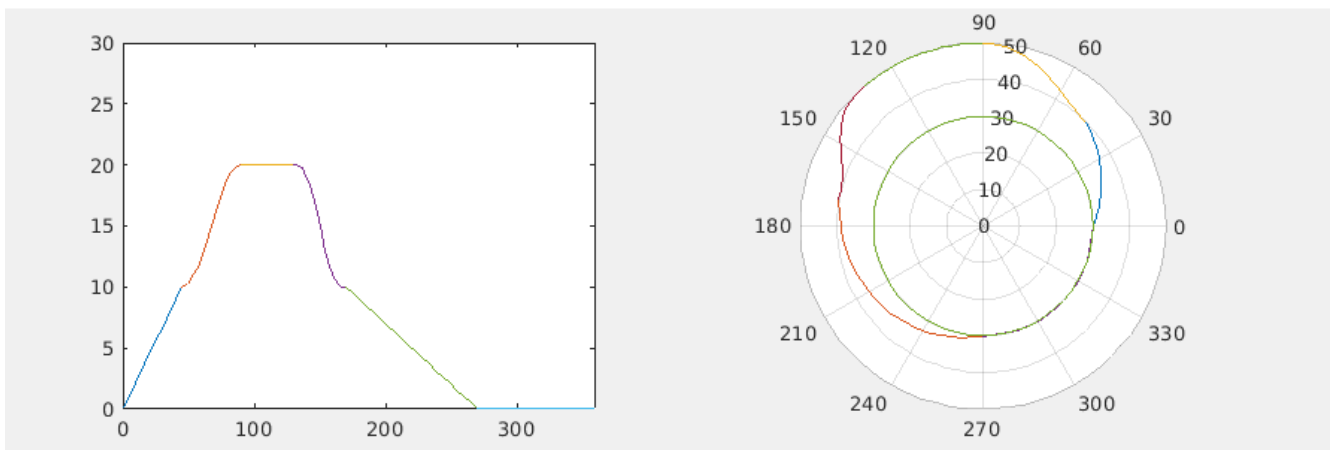
Enter segment : **20 uni in 130**

Enter segment : **10 cyl in 170**

Enter segment : **0 uni in 270**

Enter segment : **0 uni in 360**

The cam profile is immediately generated.



The polar coordinates of the profile can also be exported to an appropriate CAD software.

