Advanced Dynamics

HW2

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Calculate final time

From the equation of velocity in r direction,

$$V_r = \frac{dr}{dt} \Rightarrow V_r dt = dr \tag{1}$$

Integral both side,

$$\int_0^t V_r dt = \int_{R_0}^{R_1} dr \tag{2}$$

....

Matlab program

```
eqn_Vr = int(v, t, 0, t)-int(1, dr, R0, R1);
eqn_t = simplify(solve(eqn_Vr,t));

t_final = abs(subs(eqn_t, {R0 R1 a}, {R0n R1n an}));
```

Calculate the trajectory of the particle

The equation of radius for the particle is

$$r(t) = R_0 + \int_0^t V_r dt \tag{3}$$

And the equation of direction for the particle is

$$\theta(t) = \theta_0 + \int_0^t V_\theta dt \tag{4}$$

where $V_\theta = \omega_0 = 0.05$ rad/s

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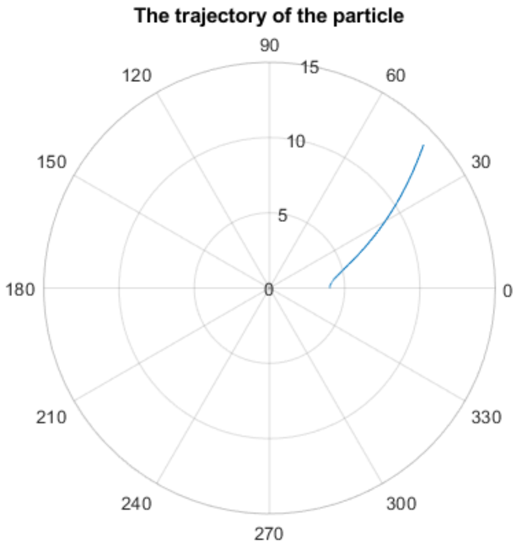
Matlab program

```
r = R0n + int(v,t);
theta = 0 + int(w,t);
tn = 0:0.01:t_final;
rn = subs(r, {a t}, {an, tn});
thetan = subs(theta, {t}, {tn});

polarplot(thetan,rn)
rlim([0 15])
title("The trajectory of the particle")
```

....

Program result



The result was not the same as the example in the textbook. In the textbook, the function input of the polar plot was using time(tn) and radius(rn). It is strange to use time value in the polar plot. The function input of the polar plot must be direction and radius. So I change the function input from time(tn) to direction(thetan).