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Shock tuning of FOX FLOAT 3 EVOL R

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ABSTRACT

FOX FLOAT 3 EVOL R air shocks are high- performance shock absorbers that use air as springs, instead of heavy steel coil springs or expensive titanium coil springs [4]. Underneath that air sleeve is a high- performance, velocity-sensitive, shimmed damping system [4]. FLOAT 3 EVOL R air shock dampers contain high pressure nitrogen gas and FOX high viscosity index shock oil separated by an Internal Floating Piston system [4]. This helps to ensure consistent, fade-free damping in most riding conditions. There are two chambers in the shocks. One of the chamber is MAIN AIR CHAMBER and other is EVOL CHAMBER. The air pressure in EVOL air chamber is adjusted to control the vehicle corner roll and bottom-out characteristics. The air pressure in MAIN air chamber is adjusted to change the ride height and suspension stiffness [4].

Keywords: *BAJA, EVOL, MATLAB, Shock tuning.*

1. INTRODUCTION

Here for these shock absorbers we had worked to get the Force vs Displacement (travel) graph mathematically. Fox Company had already given the Force vs Displacement (travel) graph in the Shocks manual but for shocks tuning we need to understand how this graph is coming. Different other things are there that also affects the shocks tuning [2]. One of the parameter is Mass flow rate [3]. We enhanced the mass flow rate by ansis analysis by checking the flux flow rate inside the pipe. We had encountered Energy for the viscous fluid and had also encountered one spring equivalent energy. Now we had differentiated that energy that gave the Force for that function and then we had integrated to the Displacement (travel) and thus we can obtain graph relation. Here we have performed three different iteration of Matlab code for different viscous constants. Other prospective we have used viscous fluid energy equation. We had Worked on different parameters and obtained at last relation between Force and Displacement (travel). Velocity obtained is horizontal one.

2. GOVERNING MODEL

Electromagnetic Field Nature of a Charged Particle

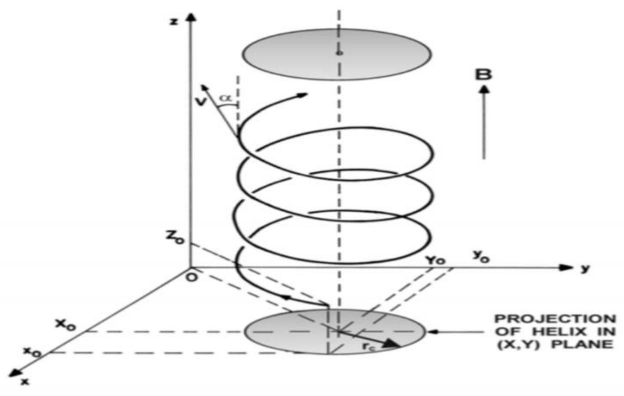
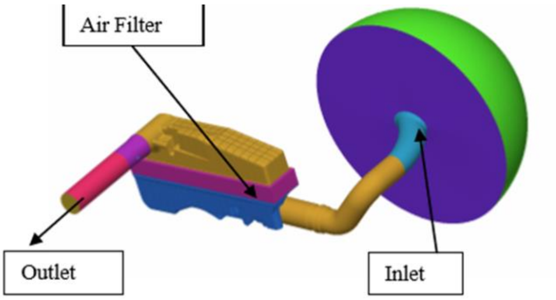


Fig. 5 Parameters of the helicoidal trajectory of a positively charged particle with reference to a Cartesian coordinate system.

Mass Flow Intake Structure



Governing Matlab Code Layout for Energy

```
y=1/2*k*x^(2);

t=y-(c*(i)*x);

i=diff(x);

u=diff(t);

r=(u-m*(v));

v=diff(diff(x));

s=int(int(r,0,x));
```

i represents velocity

v represents acceleration

Governing Mathematical Calculation

Viscous fluid potential energy [5]

$$\frac{d}{dt}\left(\frac{1}{2}\rho v^2 \delta V\right) = \vec{v}\cdot(\vec{f} - \nabla p)\delta V$$

Kinetic Energy = Work Done By All Forces

½ * M*V^(2) = Torque transmitted by Engine of 305 cc, 10hp

M= Mass of the Vehicle including Driver

Torque = 14.5 ft lb [1]

V= sqrt((14.5*2)/M)

considering weight = 150 kg

V= 0.26213 m/sec

This velocity is longitudinal velocity. Transverse velocity is used in next standard formulae

After solving viscous fluid potential energy

ln(V2/V1) = (2 * (F*(A-1))/A) * t) / ∂* V

∂= density of viscous oil
V= velocity

F= C(1) exp(2p)

X = C(2) exp(p)

Relation between the Force and Displacement

F = C *{X^(2)}
where C is a varying factor according to maximum speed of the car which depends on torque transmitted by engine and Mass of the whole Vehicle.

3. MATLAB CODE

ITERATION 1:

```
syms x;
for k=1:5000
   fprintf('value of k: %d\n',k);

end
for c=1:200;
   fprintf('value of c: %d\n',c);
end
m=200;
y=1/2*k*x^(2);
t=y-(c*(i)*x);
i=diff(x);
u=diff(t);
r=(u-m*(v));
v=diff(diff(x));
s=int(int(r,0,x));
display(s);
ezplot(s)
```

ITERATION 2:

```
syms x;
for k=1:5000
   fprintf('value of k: %d\n',k);

end
for c=1:2;
   fprintf('value of c: %d\n',c);
end
m=200;
y=1/2*k*x^(2);
t=y-(c*(i)*x);
i=diff(x);
u=diff(t);
r=(u-m*(v));
v=diff(diff(x));
s=int(int(r,0,x));
display(s);
ezplot(s)
```

ITERATION: 3

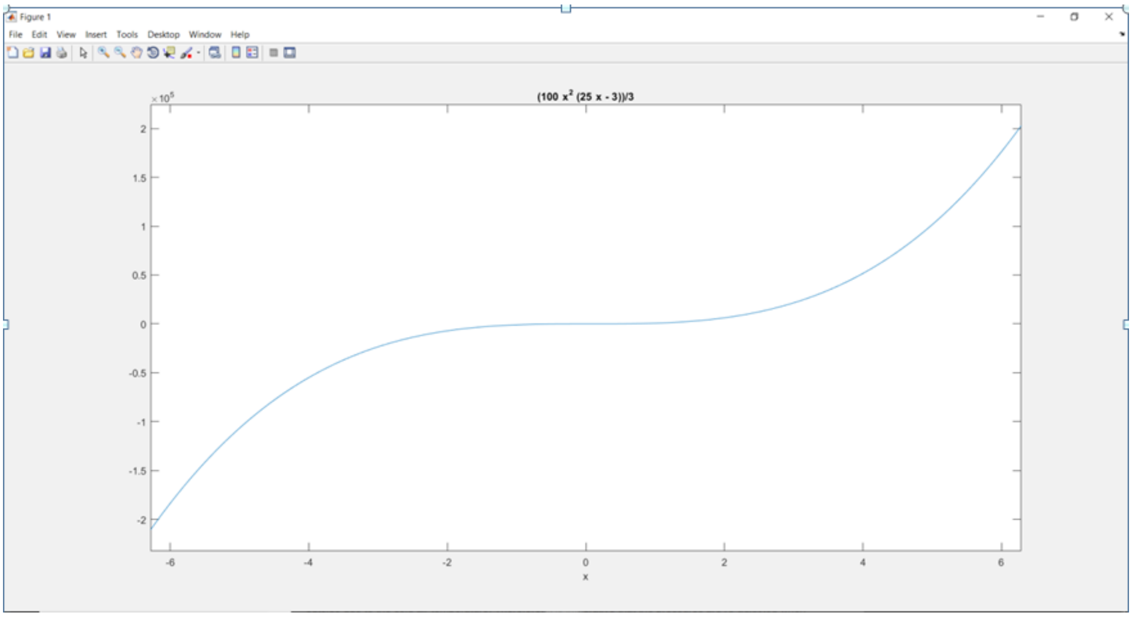
```
syms x;
for k=1:5000
   fprintf('value of k: %d\n',k);

end
for c=1:20;
   fprintf('value of c: %d\n',c);
end
```



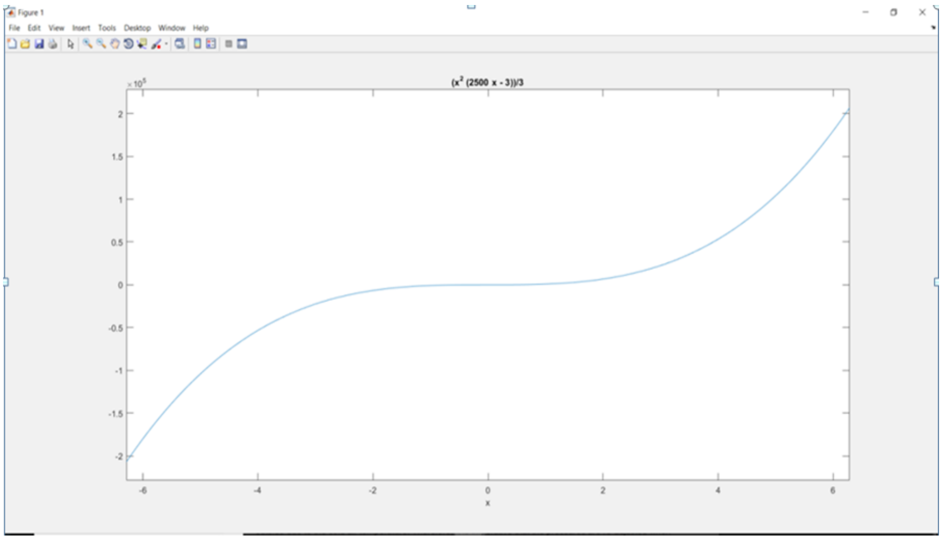
```
m=200;
y=1/2*k*x^(2);
t=y-(c*(i)*x);
i=diff(x);
u=diff(t);
r=(u-m*(v));
v=diff(diff(x));
s=int(int(r,0,x));
display(s);
ezplot(s)
```

4. MATLAB RESULT

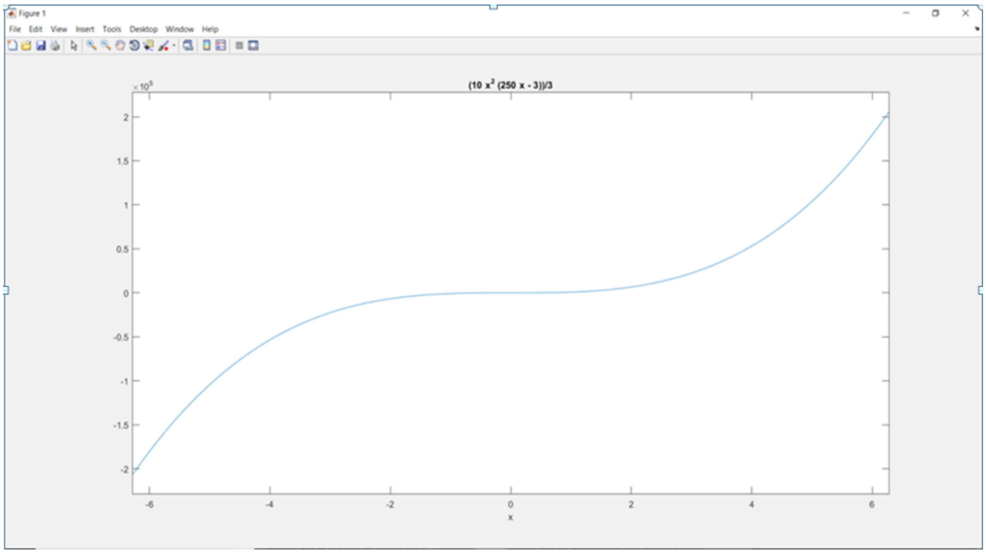
ITERATION 1:



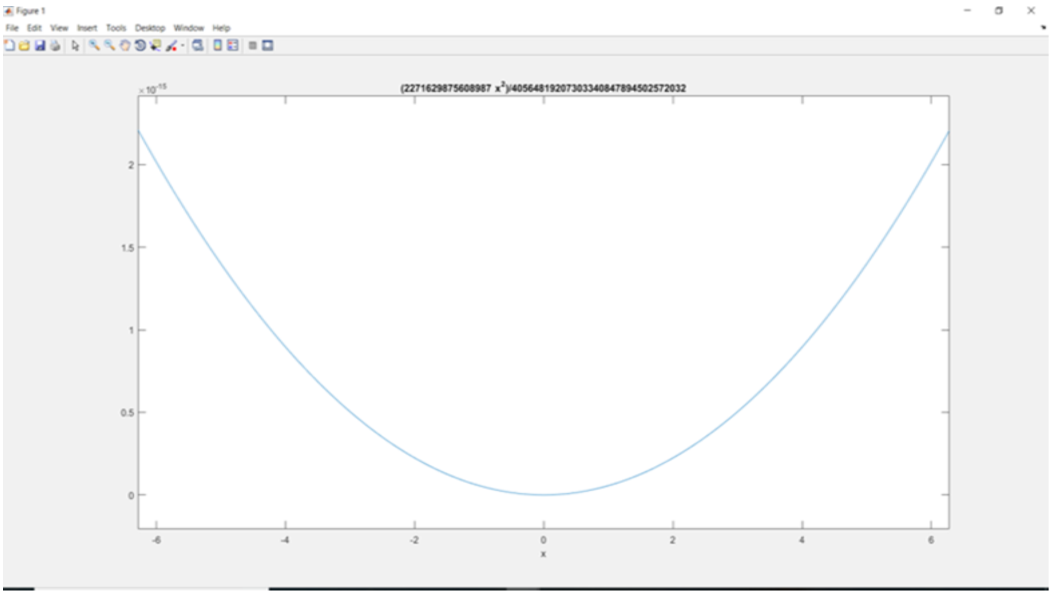
ITERATION 2:



ITERATION 3:

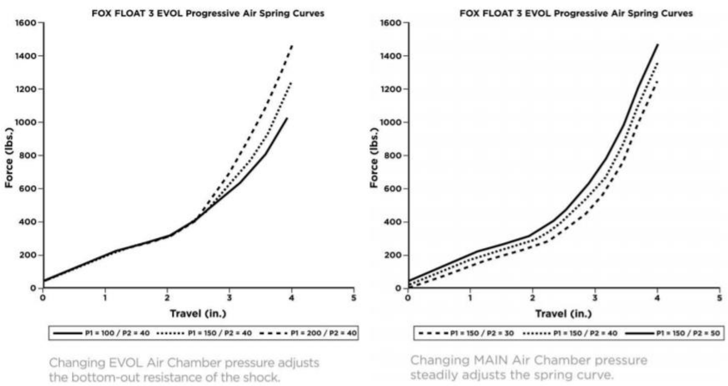


4. GOVERNING MATHEMATICAL CALCULATION RESULT

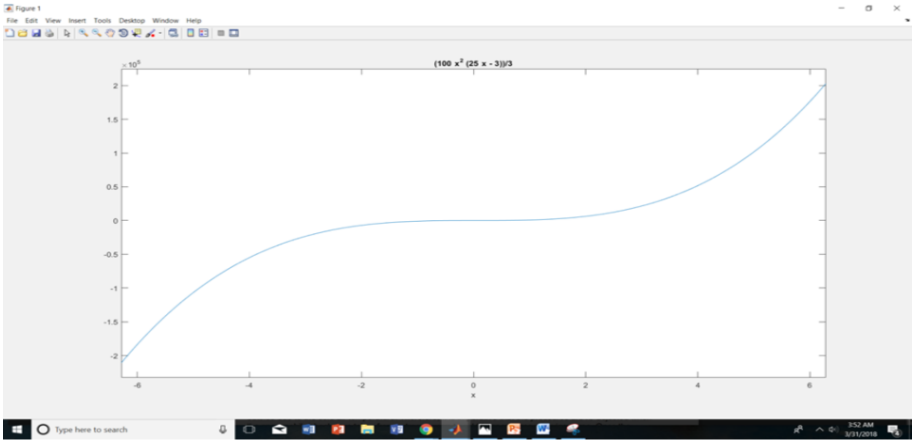


5. RESULTS

Our Desired Force Vs Travel graph for shock FOX FLOAT 3 EVOL R is achieved by Mathematical calculation and Matlab code. By this Different parameters can be controlled that will help in shock tuning [4].



For a single iteration:



6. DISCUSSION

The air pressure in EVOL air chamber is adjusted to control the vehicle corner roll and bottom-out characteristics. The air pressure in MAIN air chamber is adjusted to change the ride height and suspension stiffness. FLOAT 3 EVOL R air shock dampers contain high pressure nitrogen gas and FOX high viscosity index shock oil separated by an Internal Floating Piston system[4]. We had encountered Energy for the viscous fluid and had also encountered one spring equivalent energy. Now we had differentiated that energy that gave the Force for that function and then we had integrated to the Displacement (travel) and thus we can obtain graph relation. Other prospective we have used viscous fluid energy equation. Velocity we obtained was longitudinal and results were obtained from transverse velocity.

Pressure Analyzed by Shocks manufacturers:

Reference Air Pressures

	EVOL Air Chamber	Main Air Chamber
Mountain/Backcountry	100-150	45-65
Performance/Trail	160-180	55-95
Sno-Cross/X-Country	200-250	100-120

7. REFERENCES

[1] BAJA SAE ENGINE SPECIFICATIONS
[2] MICHIGAN UNIVERSITY DAMPING REPORT
[3] BAJA SAE ENGINE TESTING REPORT
[4] FOX EVOL FLOAT 3 SHOCKS MANUAL
[5] On the acceleration of Viscous Fluid through an Unbounded Channel: University of Southern California, S. S. SRITHARAN* Department of Aerospace Engineering, University of Southern California, Los Angeles, California 90089-I I91 Submitted by John Lavery Received November 2, 1990.

