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ANALYSIS OF DIFFERENT SHOCK ABSORBER USING FFT ANALYSER

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Abstract— In this comforting age shock absorber play an important role to reduce shocks and vibrations. Due to high shock absorber today automobile achieve high speed with comfort. Shock absorbers are an important part of the suspension systems of automobiles, motorcycles, and other wheeled or tracked vehicles, as well as aircraft landing gear and the supports for many industrial machines. Large shock absorbers have also been used in structural engineering to reduce the susceptibility of structures to earthquake damage and resonance. A transverse mounted shock absorber, called a yaw damper, helps keep railcars from swaying excessively from side to side. It also use in cams-follower arrangement. The vehicles suspension systems are mainly classified in three categories1.passive suspension system 2.semi-active suspension system 3.active suspension system.

Here we are analysing shock absorbers of different bikes by using FFT analyser in DEWESOFT software here we obtained acceleration time graph for different shock absorbers for bike moving on the road without constraints by piezoelectric sensors. We analysed the results obtained by sensors in the FFT analyser and furnished the result of different shock absorber. So that we will be able to suggest which is better and also to tell which type of material will help to increase the ability of shock absorber.

Keywords— **Shock absorber, FFT Analyser, Spring material, Suspension system, *DEWESOFT*.**

I. INTRODUCTION

A suspension system or shock absorber is a mechanical device designed to smooth out or damp shock impulse, and dissipate energy. The shock absorbers duty is to absorb or dissipate energy. In a vehicle, it reduces the effect of travelling over rough ground, leading to improved quality, and increase in comfort due to substantially reduced amplitude of disturbances. When a vehicle is travelling on a level road and the wheels strike a bump, the spring is compressed quickly. The compressed spring will attempt to return to its normal loaded lengthened, in so doing, will rebound past its normal height, causing the body to be lifted.

The weight of the vehicle will then push the spring down below its normal loaded height. This in turn, causes the spring to rebound again. This bouncing process is repeated over and over, a little less each time, until the up-and-down movement finally stops. If bouncing is allowed to go uncontrolled, it will not only cause an uncomfortable ride but will make handling of the vehicle very difficult. The design of spring in suspension system is very important.

II. PHYSICAL PROPERTIES OF DIFFERENT SPRING MATERIALS

Steel alloys are the most commonly used spring materials. The most popular alloys include high-carbon (such as the music wire used for guitar strings), oil-tempered low-carbon, chrome silicon, chrome vanadium, and stainless steel. Other metals that are sometimes used to make springs are beryllium copper alloy, Phosphor bronze, and titanium. Rubber or urethane may be used for cylindrical, non-coil springs. Ceramic material has been developed for coiled springs in very high-temperature environments. One-directional glass fiber composite materials are being tested for possible use in springs.

- **High Carbon Cold Drawn spring steel /Music wire (0.85-0.95% C)**

TABLE I PROPERTIES OF HIGH CARBON COLD DRAWN SPRING STEEL

Ultimate tensile strength	2040 Mpa
Ultimate yield strength	1760 Mpa
Shear yield strength	1060 Mpa
Endurance limit in reversed bending	950 Mpa
Endurance limit in torsional loading	560 Mpa
Modulus of elasticity in tension or comp.	210 Gpa
Modulus of elasticity in shear	30 Gpa

- **Chromium Vanadium steel (SAE 6150)**

TABLE II PROPERTIES OF CHROMIUM VANADIUM STEEL

Tensile strength	1690 Mpa
Elongation	20%
Shear yield strength	770 Mpa
Endurance limit in bending	630 Mpa
Endurance limit in torsional loading	390 Mpa
Modulus of elasticity in tension/comp.	220 Gpa
Modulus of elasticity in shear	85 Gpa

- **Chromium silicon molybdenum steel (SAE 9250)**

TABLE III PROPERTIES OF CHROMIUM SILICON MOLYBDENUM STEEL

Ultimate tensile strength	1550 Mpa
Ultimate yield strength	1130 Mpa
Shear yield strength	670 Mpa
Endurance limit in reversed bending	560 Mpa
Endurance limit in torsional loading	340 Mpa
Modulus of elasticity in tension or comp.	211 Gpa
Modulus of elasticity in shear	80 Gpa

- **Phosphor bronze**

TABLE IV PROPERTIES OF PHOSPHOR BRONZE

Ultimate tensile strength	690 Mpa
Ultimate yield strength	350 Mpa
Shear yield strength	210 Mpa
Endurance limit in reversed bending	320 Mpa
Endurance limit in torsional loading	140 Mpa
Modulus of elasticity in tension or comp.	110 Gpa
Modulus of elasticity in shear	44 Gpa

- **Stainless steel**

TABLE V PROPERTIES OF STAINLESS STEEL

Ultimate tensile strength	1350 Mpa
Yield strength in comp.	820 Mpa
Yield strength in shear	680 Mpa
Endurance limit in reverse bending	610 Mpa
Modulus of elasticity in tension or comp.	204 Gpa
Modulus of elasticity in shear	82 Gpa
BHN	38

- **Cost indices to compare the relative cost of different spring wires/material.**

TABLE VI PROPERTIES OF COST INDICES

Spring materials	Cost index
Hard drawn spring steel wire	1.0
Music wire	3.5
Alloy steel	4.0
Stainless steel	8.0

III. INTRODUCTION TO DEWE SOFT- 43

Figure 1. DEWE SOFT- 43

Dewesoft was founded back in year 2000 and today Dewesoft products are being used in many applications by global market leaders all around the world. Dewesoft positioned itself in the global market with innovations in software and hardware products. We gained trust with our customers by keeping a close contact and tight support on all levels from sales down to technical support. Dewesoft handles complete instrument design, development, and manufacturing all in one hand.

Franz Degen and Herbert Wernigg, already founders of the PC-instruments company DEWETRON back in 1989, started with Dr. Jure Knez and Andrej Orozen the Dewesoft software company in the year 2000. The Dewesoft hardware, the perfect match to the already well established DEWESoft™ software, offers now the next generation in networked data acquisition. The modular hardware concept with many new technologies like dual core ADC and digital high end isolation shows the clear next DAQ generation. What sets Dewesoft apart from most other DAQ-companies is the complete development and manufacturing of the mechanics (enclosure), electronics (hardware), software, instruments know-how and customized solutions.

IV. EXPERIMENTAL SETUP

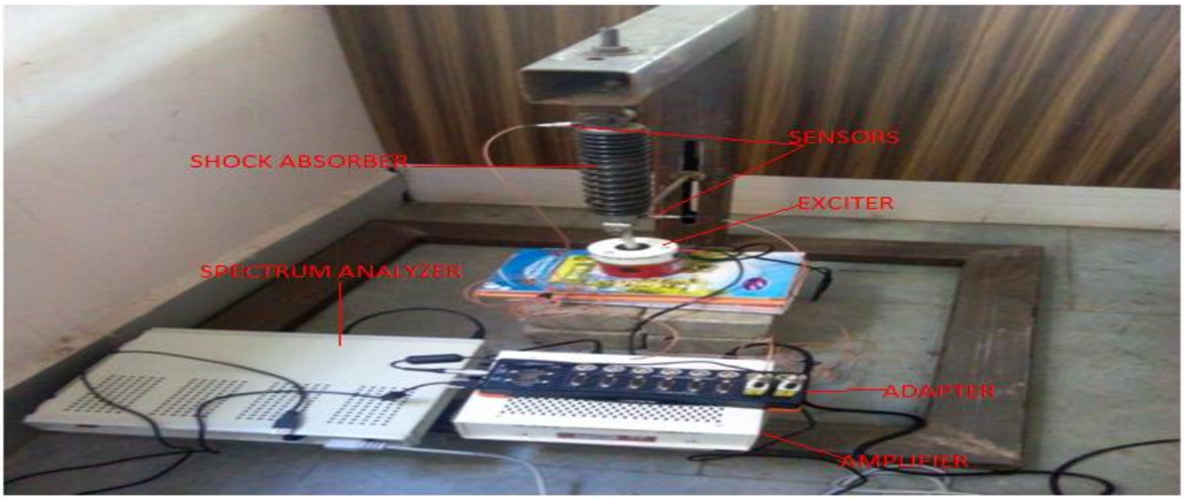

Figure 2. Experimental setup.

Figure 3. Sensors positioning.

V. EXPERIMENTAL ANALYSIS OF SHOCK ABSORBER

1. Shine

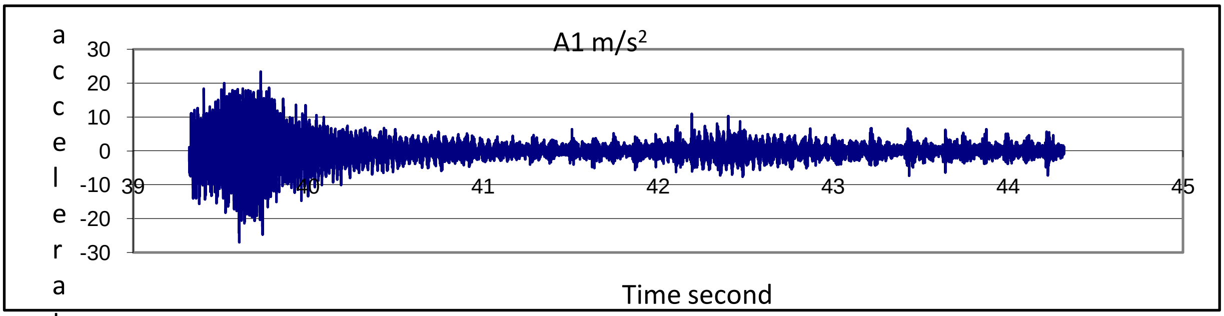

Figure 4. Shine

2. Pulsar

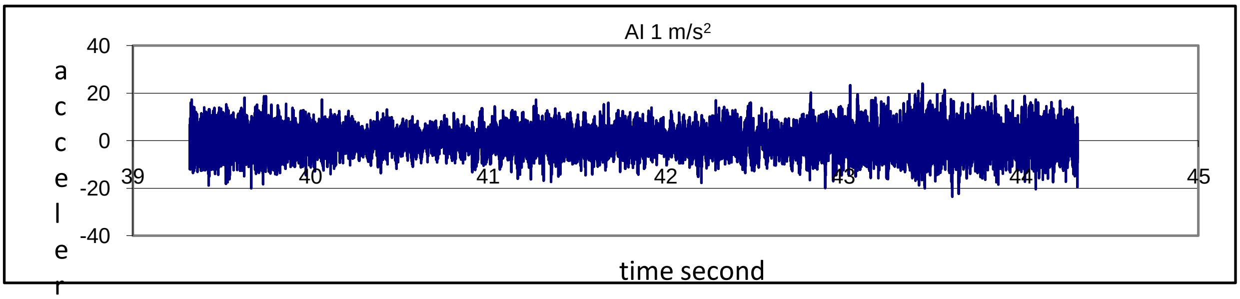

Figure 5. Pulsar

3. Passion

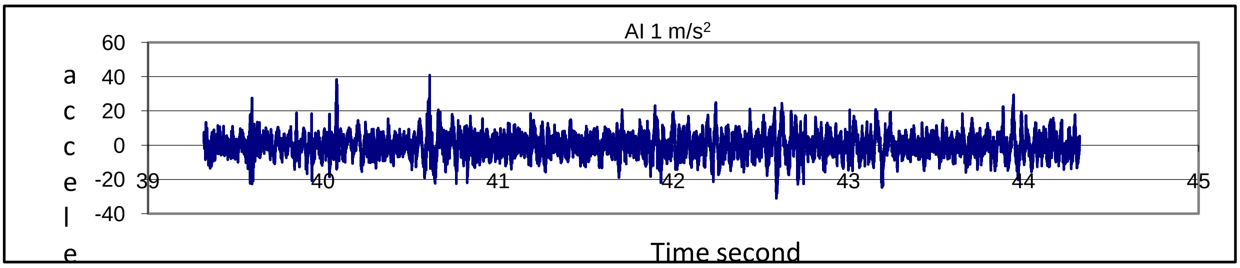

Figure 6. Passion

4. Splendor

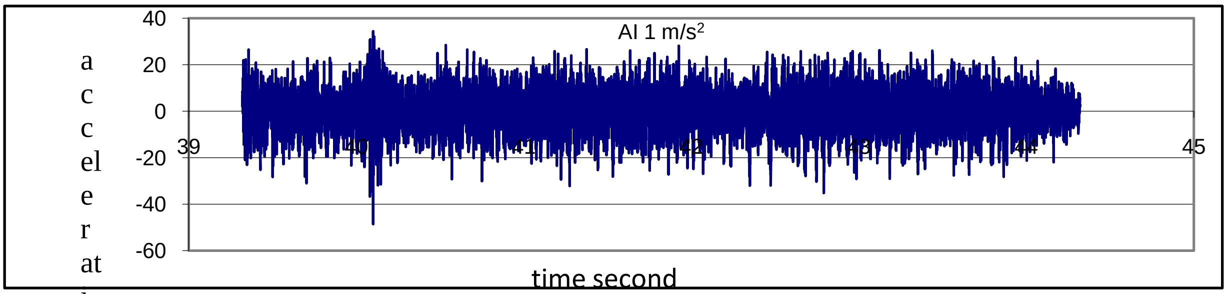

Figure 7. Splendor

V-A. OBSERVATIONS

Following are the observations of the amplitude found when the vehicle is moving on the road without constraint.

1. Table for the maximum displacement at constraint in positive (upward) direction.

TABLE VII MAXIMUM +VE DISPLACEMENT (WITHOUT CONSTRAINT)

Sr.No	Vehicle	Maximum Amplitude(+) M/S^2	Average Amplitude M/S^2
1.	SPLENDOR	45.657	20 - 30
2.	PASSION PLUS	40.07	15-20
3.	SHINE	23.32	00-10
4.	PULSAR	24.10	05-15

2. Table for the maximum displacement of shock absorber at breaker in Negative (downward) direction.

TABLE VIII MAXIMUM -VE DISPLACEMENT (WITHOUT CONSTRAINT)

Sr.No	Vehicle	Maximum Amplitude (+) M/S^2	Average Amplitude (-) M/S^2
1.	SPLENDOR	48.524	20-30
2.	PASSION PLUS	31.145	10-20
3.	SHINE	26.91	00 -07
4.	PULSAR	23.63	05 -15

V-B. ANALYSIS OF THE FFT GRAPHS OF THE SHOCK ABSORBER OF THE VEHICLE MOVING WITH THE CONSTANT SPEED.

1. The Analysis of the FFT graphs of the different Vehicles moving on the road without breaker shows that even though the Splendor is moving on the road without constraint the variation in its Amplitude is quite high, we can conclude that the dampening performance of the splendor reduced to a very low level.

2. Analysis of the Passion's shock absorber concludes that the maximum Amplitude of the Passion vehicle is not that high but its average amplitude is in the range 15-20.

3. Shine's FFT analysis Shows that as vehicle is new its dampening performance is very good, its shock dampening capability is quite high.

4. FFT analysis of the pulsar concludes that though the vehicle is a year old but the dampening performance is quite good and is competitive to the shine

V-C COMPARISONS OF READINGS

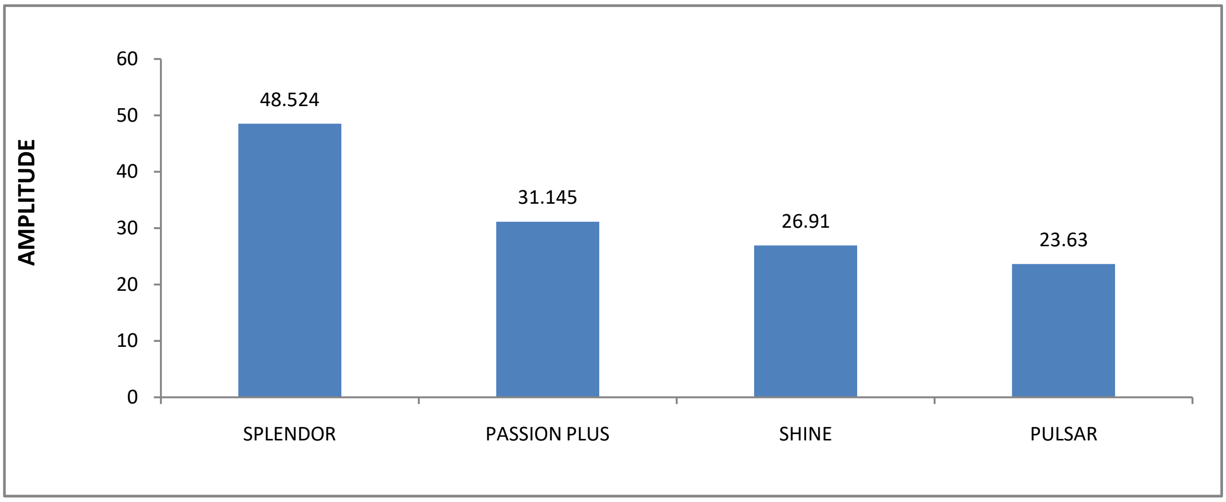

Figure 8. Comparison of readings

VI. CONCLUSION

01 Experimental analysis of the shock absorber by FFT analyzer, aimed at studying the shock dampening capacity of the different vehicles shock absorber.

02 By studying the shock absorber of different vehicles like pulsar, passion plus, splendor and shine, we come to conclude that the shock absorber has high effect of ageing on it.

03 With the increase in running life if the vehicle ability to damp the shock get reduced.

04 With the analysis of the vehicles we also come to conclude that , though the pulsar is very older than shine, still it competitive to the shine which shows that there are certain parameter like type of material of spring in shock absorber , type of rod in shock absorber which might have dividing the capability of shock absorber.

05 The capability can be studied by changing the material and by doing static analysis using constant load and constant vibration using exciter.

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