TRANSMISSIBILITY AND STIFFNESS TEST BY USING SHOCK ABSORBER TEST RIG

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ABSTRACT:

Shock absorber is very important termin automobile industries. They are used for the driving comfort and driving safety. This paper presents performancecharacteristics of the shock absorbers under real conditions. Dynamic behaviors of the absorber are studied by computer simulation and experimental testing and are validated with MATLAB results. The road disturbance is generated in the model by giving speed brakes fixed on drum which is rotated by using motor and plotted its dynamic characteristics curve for different values of spring stiffness for oil.

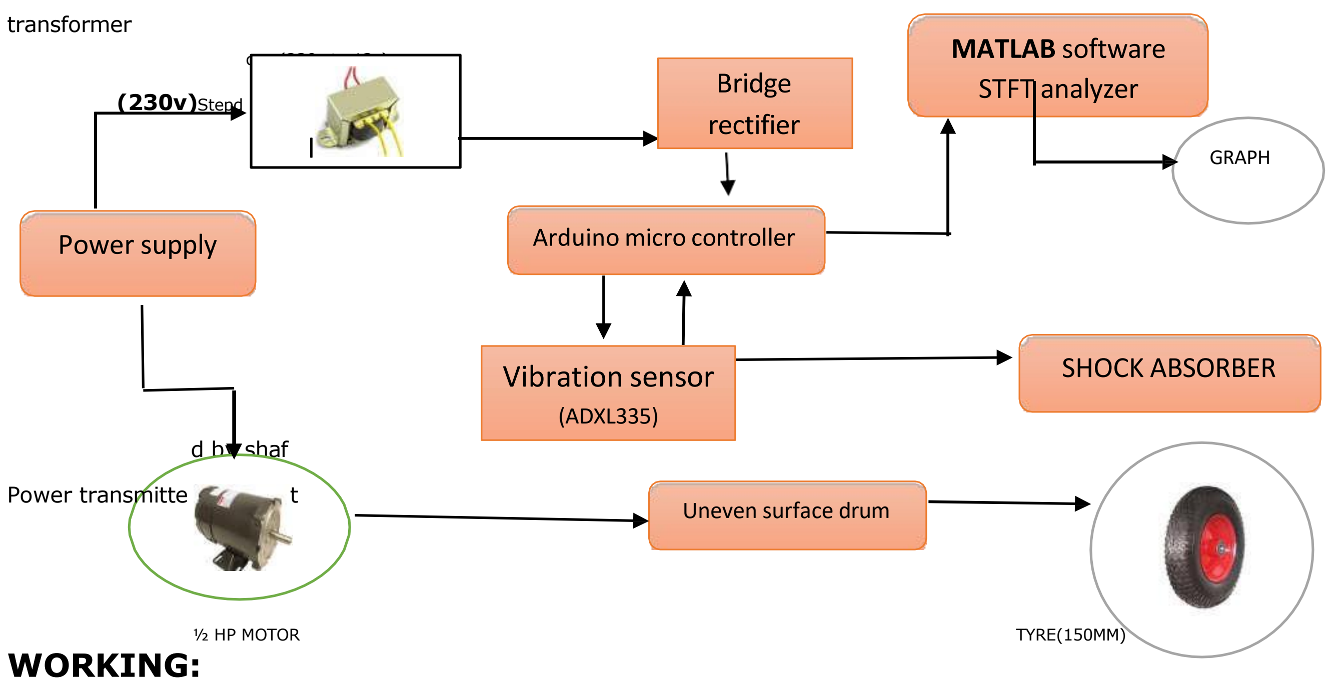
INTRODUCTION:

The Shock absorber is a Suspension System which designed mechanically to control shock impulse and dissipatekinetic energy it reduce amplitude of disturbance leading to increase to comfort and improve ride quality shock absorbers minimize the effect of travelling rough ground nowadays modern vehicles comes along with shock absorbers to tolerate any type of bouncy conditions if supposedly shock absorber is not used to control excessive suspension movement stiffer springs will be used the suspension system of an automobile is one which separates the wheel assembly from the body.

The primary function of the suspension system is to isolate the vehicle structure from shocks and vibration due to irregularities of the road surface. The suspension system is used to support weight Absorber and damping road shocks and helps maintain tire contact as well as proper wheel to chassis relationship. A vehicle in motion is more than wheels turning as the wheel revolves, the suspension system turns in dynamic state of balance,continuously compensatingand adjusting for changingdriving conditions. According to road profile. Suspension of vehicle need to analyze before manufacturing. This is because to make sure components in shock absorbers system remain in good conditions. The shock absorbers system need analyze how shocks to see how they are going through perform in worst case scenario. A safe vehicle must be able to stop and which to reduce the tendency of a tire to lift of the road. This affects and breaking, steering, cornering and overall stability of the vehicle. The removal of shock absorber from suspension can cause the vehicle bounce up and down. It possible for the vehicle to driven, maneuver over a wide range of road conditions. The good contact between the wheel tires and road will able to stop and maneuver quickly.

Shock absorbers are also critical for tire to road contact but if the suspension drops from the driving over a saver bump, The rear spring can fall out. Basically, shock absorber must be replaced after driving exceeds certain distance. But This actually not should have been followed if there are no defective.

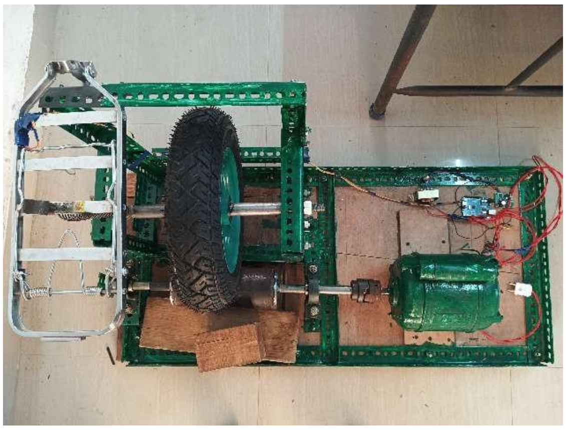
BLOCK DIAGRAM:



WORKING:

Shaft is mounted in bearing on which drum is mounted. Speed breaker profiles are welded on drum. On drum wheel assembly is mounted.An 3A 230V Motor is running the Shaft by gear. Motor shaft rotates the Drum.

Shaft which simultaneously rotates the wheel which in on drum.Shock absorber will get compress load around 500gram to 1000gram.Compressed load depends on Motor Capacity. We are using 3Amp Motor.



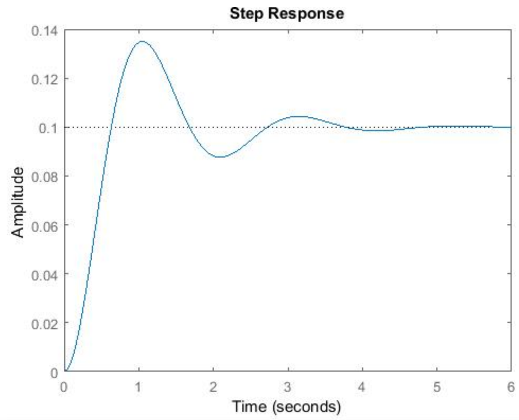
Accelerometer/force sensors will attached to shock absorbers.The analog value of the sensor is given the Arduino UNO microcontroller.The Shock absorber data is given to MATLAB STFT through out RS232 port.In PC we are displaying result.

STFT:

The short-time Fourier transform (STFT), is a Fourier-related transform used to determine the sinusoidal frequency and phase content of local sections of a signal as it changes over time.

Why we are using STFTinstead of FFT:

STFT is not a hardware device. It is an algorithm available in MATLAB. We have to give Raw signal to MATLAB.We need only Accelerometer/force sensors only. We are Displaying Shock absorber Step response output in MATLAB.;



FFT analyzer is sensor combined device, its Price is more(around 45k to 60k depends on numbers of channels).

HARDWARE DETAILS:

Shock absorber: Shock absorbers are pump-like devices which keep your vehicles tires in contact with the road surface by controlling the rebound of its suspension springs.

1. **STEP-DOWN TRANSFORMER-12V**

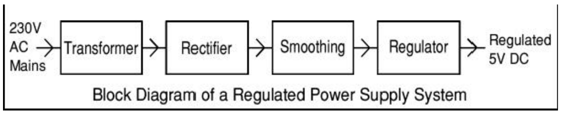
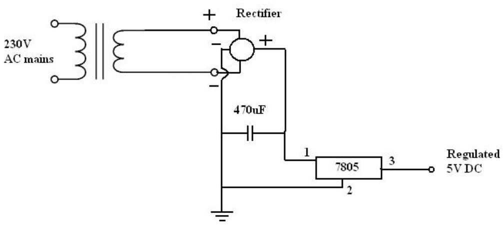


FIG: BLOCK DIAGRAM OF POWER SUPPLY



The figure shows the block diagram of a regulated power supply system. It consists of a step down transformer which transfers electrical energy from one circuit to another through inductively coupled conductors. It converts 230V AC supply into 12V AC supply. This is brought about by means of a varying current in the primary winding (input coil) which creates a varying magnetic field in the core of the transformer. This varying magnetic field induces a varying EMF or voltage in the secondary winding (output coil). In an ideal transformer, the induced voltage in the secondary winding (V_S) is in proportion to the primary voltage (V_P), and is given by the ratio of the number of turns in the secondary (Ns) to the number of turns in the primary (Np), that is,

$$Vs/Vp = Ns/Np$$

Therefore, by appropriately decreasing the number of turns in secondary, its voltage can be stepped down. This voltage is given to a rectifier circuit to convert the AC to DC. The output got from rectifier may be a varying DC output and hence requires smoothing. This is brought about by means of a capacitor. The capacitor (470µF) charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output. This output may contain small ripples which are removed by means of a regulator. The regulator used in the circuit is L7805CV to get a regulated +5V DC output. The output got from the rectifier is given to pin 1 of the regulator, pin 2 is grounded and the regulated +5V output is obtained at pin 3 of the regulator. The circuit diagram of the above description is shown in figure: 3.23.

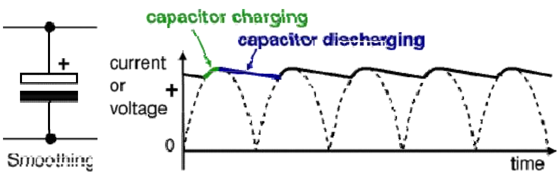
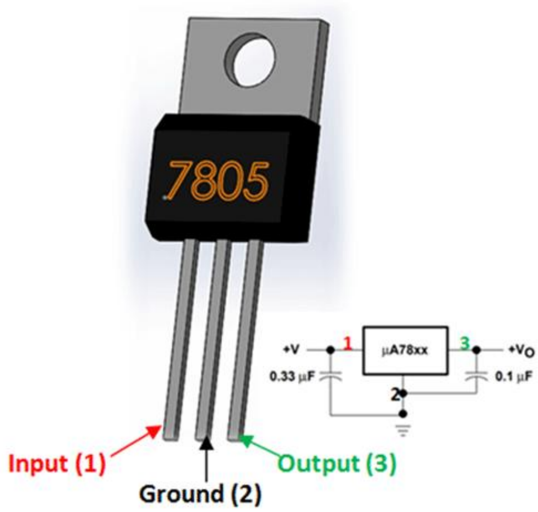


Fig: Graph of charging and discharging of a capacitor

2. Crystal Oscillator – 8 MHz

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits designed around them became known as "crystal oscillators."

3. Regulator – 7805
General Description



The LM7805 monolithic 3-terminal positive voltage regulators employ internal current-limiting, thermal shutdown and safe-area compensation, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 1.0A output current.They are intended as fixed voltage regulators in a wide range of applications including local (on-card) regulation for elimination of noise and distribution problems associated with single-point regulation. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents. Considerable effort was expended to make the entire series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply.

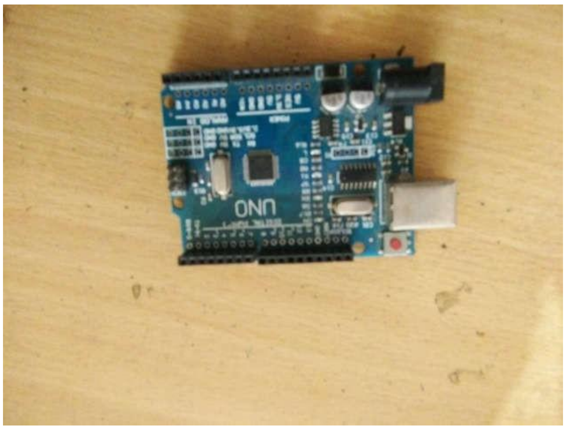
The LM78 Series has 5V, 12V, and 15V regulator options are available in the steel TO-3 power package. The LM340A/LM340/LM78XXC series is available in the TO-220 plastic power package, and the LM340-5.0 is available in the SOT-223 package, as well as the LM340-5.0 and LM340-12 in the surface-mount TO- 263 package.

Features

- Complete specifications at 1A load
- Output voltage tolerances of ±2% at Tj = 25°C and ±4% over the temperature range (LM340A)
- Line regulation of 0.01% of VOUT/V of ΔVIN at 1A load (LM340A)
- Load regulation of 0.3% of VOUT/A (LM340A)
- Internal thermal overload protection
- Internal short-circuit current limit
- Output transistor safe area protection

P+ Product Enhancement tested

4. ArduinoUno



The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

Revision 3 of the board has the following new features:

1. pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes.
2. Stronger RESET circuit.
3. Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

ARDUINO UNO FEATURES

Microcontroller ATmega328

Operating Voltage 5V

Input Voltage (recommended) 7-12V

Input Voltage (limits) 6-20V

Digital I/O Pins 14 (of which 6 provide PWM output)

Analog Input Pins 6

DC Current per I/O Pin 40 mA

DC Current for 3.3V Pin 50 mA

Flash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader

SRAM 2 KB (ATmega328)

EEPROM 1 KB (ATmega328)

Clock Speed 16 MHz

The Arduino reference design can use an Atmega8, 168, or 328, Current models use an ATmega328, but an Atmega8 is shown in the schematic for reference. The pin configuration is identical on all three processors.

Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however,

the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the

voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply

voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

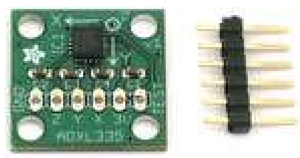
5V.This pin outputs a regulated 5V from the regulator on the board. The board can be supplied

with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of

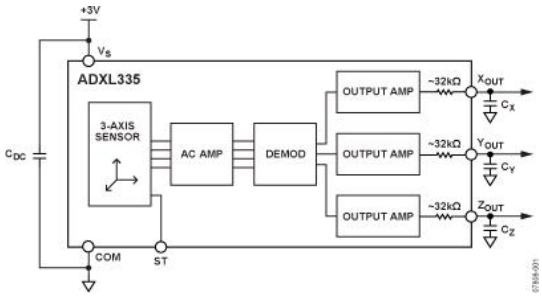
the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.

3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA. GND. Ground pins.

6. Vibration SENSOR



The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tiltsensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.



Applications

- Cost sensitive, low power, motion- and tilt-sensing applications

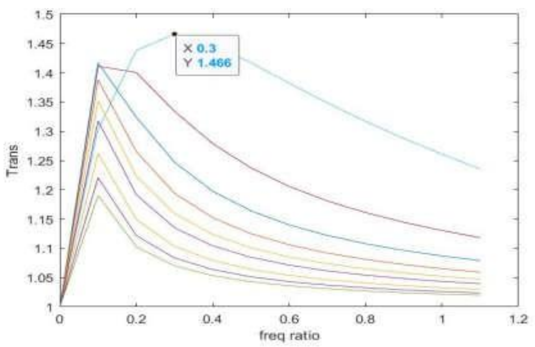
- Vibration Application
- Automobile Application
- Disk drive protection
- Image stabilization
- Sports and health devices

TABLE: MESUREMENT OF TRANSMISSIBILITYAND STIFFNESS:

S.NO	Weights(kg)	Stiffness of spring(N/mm)	Experimental stiffness of spring(N/mm)	MATLAB Transmissibility of spring	MATLAB frequency ratio of spring
1	0.5	150	8.170	1.459	0.3
2	1	150	16.356	1.510	0.4
3	3	150	49.050	1.578	0.6
4	5	150	81.750	1.500	0.4
5	9	150	147.500	1.466	0.3
6	10	150	163.200	1.459	0.3

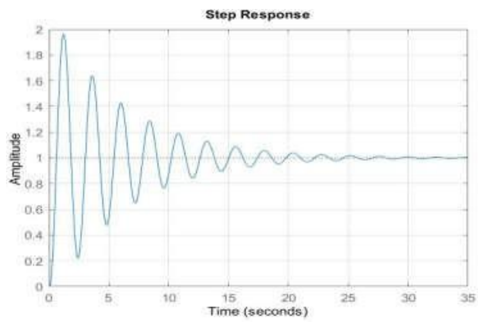
Breakable point is at 163.200(10kg)

Transmissibility(y);



Y=1.466; X=0.3

Step-response graph:



Conclusion:

- From this suspension testing setup we can test suspensions at different loads and constant speed.

- By changing different loads we can find out optimum motion transmissibility.

With ultimate objective of studying and plotting dynamic characteristics for suspension using single wheel model of suspension analysis to produce large number of results. However it concludes the project work with following points:

1. The suspension system gives best performance when designed to be slightly under-damped.
2. From experimental results and graphs we can conclude that for goof ride, transmissibility should be as low as possible and this can be obtained by using low damping constant and high spring stiffness and suspension gives the better results.

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