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A Performance Optimization and Analysis of Torque Transmissibility by Using Experimental Techniques

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Abstract :In many vibration problems, the primary excitation force typically has a repetitive periodic nature, and in some cases this periodic forcing function may be even purely sinusoidal. Examples are excitations due to mass eccentricity and misalignments in rotational components. In basic terms, the frequency response of a dynamic system is the response to a pure sinusoidal excitation. As the amplitude and the frequency of the excitation are changed, the response also changes. A typical problem is a rotating machine (such as a pump, AC compressor, blower, engine, etc) mounted on a roof, or on a floor above the ground floor. The problem is usually most apparent in the immediate vicinity of the vibration source. However, mechanical vibrations can transmit for long distances, and by very circuitous routes through the structure of a building, sometimes resurfacing hundreds of feet from the source. A related problem is the isolation of vibration-sensitive machines from the normally occurring disturbances in a building (car or bus traffic, slamming doors, foot traffic, elevators…)
Using Spring, Rubber and Wood isolator, various frequencies, various eccentric masses, various eccentricity measuring the torque transmissibility and graphs are analyzed.

I. INTRODUCTION

Vibration can be defined as simply the cyclic or oscillating motion of a machine or machine component from its positions of rest. When motorized equipment, such as electric motors, fans or pumps, is mounted to a solid structure, energy can be transferred from the equipment to the structure in the form of vibration This vibration often radiates from the structure as audible noise and potentially reduces performance or damages equipment. Most portable electronics, CD drives and vehicle- mounted electronics are especially sensitive to vibration and shock and must be isolated from that energy to ensure proper performance.

Forces generated within the machine cause vibration. These forces may: (i) Change in direction with time, such as the force generated by a rotating unbalance. (ii) Change in amplitude or intensity with time, such as the unbalanced magnetic forces generated in an induction motor due to unequal air gap between the motor armature and stator (field). (iii) Result in friction between rotating and stationary machine components in much the same way that friction from a rosined bow causes a violin string to vibrate. (iv)Cause impacts, such as gear tooth contacts or the impacts generated by the rolling elements of a bearing passing over flaws in the bearing raceways. (v) Cause randomly generated forces such as flow turbulence in fluid-handling devices such as fans, blowers and pumps; or combustion turbulence in gas turbines or boilers.

A.Characteristics of Vibration

Vibration is simply defined as "the cyclic or oscillating motion of a machine or machine component from its position of rest or its 'neutral' position." Whenever vibration occurs, there are actually four forces involved that determine the characteristics of the vibration. These forces are: 1. The exciting force, such as unbalance or misalignment. 2. The mass of the vibrating system, denoted by the symbol (M). 3. The stiffness of the vibrating system, denoted by the symbol (K). 4. The damping characteristics of the vibrating system, denoted by the symbol (C). The exciting force is trying to cause vibration, whereas the stiffness, mass and damping forces are trying to oppose the exciting force and control or minimize the vibration. Perhaps the simplest and easiest way to demonstrate and explain vibration and its measurable characteristics is to follow the motion of a weight suspended by a spring. This is a valid analogy since all machines and their components have weight (mass), spring-like properties (stiffness) and damping. The motion of the mass from top to bottom range and back to the initial starting position in the vertical direction is referred to as one cycle, and it has all the characteristics needed to define the vibration. Continued motion of the spring-mass system will simply be repeating these measurable characteristics.

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The characteristics needed to define the vibration include:

1) Frequency
2) Displacement
3) Velocity
4) Acceleration
5) Phase
6) Vibration Frequency

(t)= vertial displacement, f(t)= excitation force

If we neglect damping, the vertical motion of the system, x(t) can be shown to be:$x(t) = \frac{Fo/_k}{1-r^2}\sin\omega t$

Where $\quad r=\omega/\omega_{n,}\omega_n=\sqrt{\frac{k}{m}}$

The system has a natural, or resonant frequency, at which it will exhibit a large amplitude of motion, for a small input force. In units of Hz (cycles per second), this frequency, fn is :$fn = \frac{\omega_n}{2\pi}=\frac{1}{2\pi}\sqrt{\frac{k}{m}}$

The ratio of transmitted force to the input force is called transmissibility, T=$\frac{f_t}{f_0}$

The transmissibility including the effect of damping is: T=$\frac{\sqrt{1+2\xi r^2}}{\sqrt{(1-r^2)^2(2\xi r)^2}}$Where $\xi=\frac{c}{2m\omega_n}$

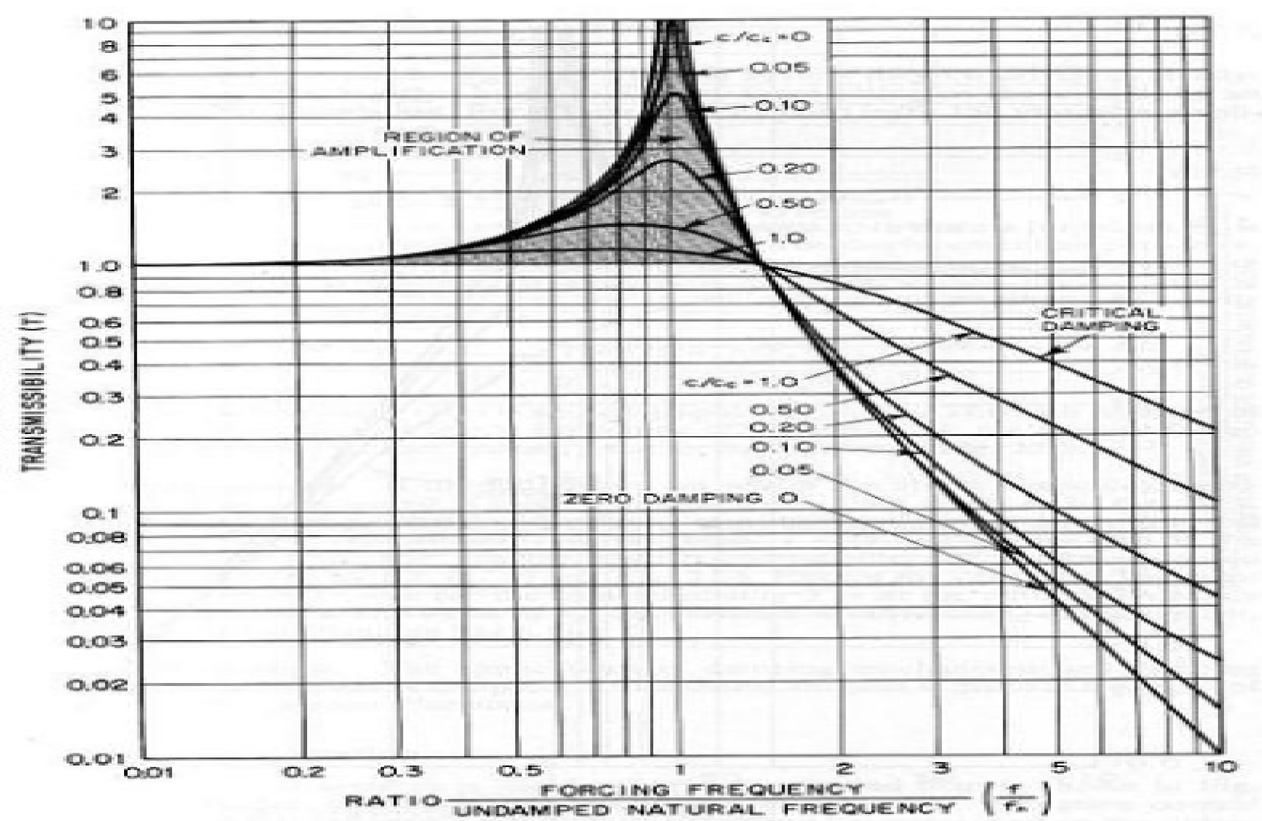

Fig no. 1 Transmissibility Vs Frequency Ratio

II. TEST RIG AND COMPONENT SPECIFICATION

The whole assembly is supported on metallic stand above which clips are welded.
The use of this clips is to provide support to the load cell assembly (weighing machine).
The base plate is fitted over top surface (measuring probe) of load cell by means of nut & bolt.

Isolators are fixed between two two metallic plates which have holes drilled at its four corners for fitting purpose.
The isolator is fitted over the base plate by means of nut & bolt to bottom plate of isolator.
The motor is placed over the upper plate of isolator & they are bolted together to provide the frequent engagement & disengagement of various types of isolators sets.
On the motor shaft the disk is fitted which rotate with the speed of motor.
The rotating disc is fixed to shaft of motor with the help of pulley which is rigidly connected to motor shaft.
The holes are provided on plate various distances to provide provision for installation of eccentric masses.

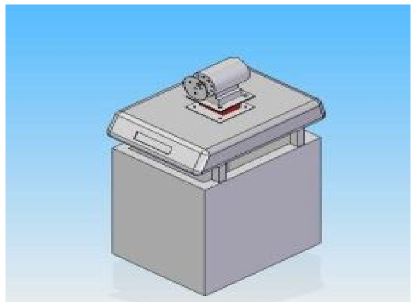

Fig no. 2 Assembly of test rig

The Test Rig Consist Of Following Component

.A. motor: single phase ac supply

1) HP=1/12
2) Volt=220/230
3) Watt=50
4) Amp=0.75
5) RPM=9000
6) Cycle= 50

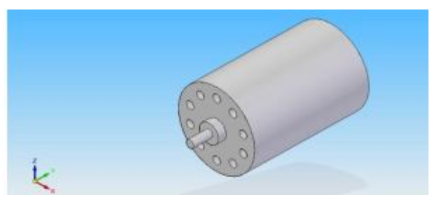

Fig no. 3 Motor

B. Rotating disc

1) Radius=0.04mm
2) Material- Steel Plate
3) Thickness= Appro. 1mm

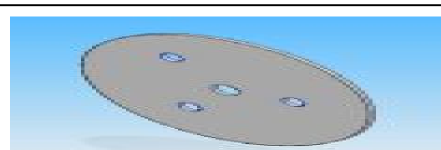

Fig no. 4 Rotating disc

C. Eccentric masses

a. 10gm (0.01kg)
b. 15gm(0.015kg)
c. 20gm(0.020kg)
d.
e.

Fig no. 5 Essentric mass

D. Isolator : spring

Number of spring: 4Stiffness k=27552 N/mm

Stiffness Ke= 4k =4*27552 =110208 N/mm
ω_n= 178 Rad/Sec

1) Spring Diameter=35mm
2) Coil Diameter=45mm
3) Spring Length=68mm

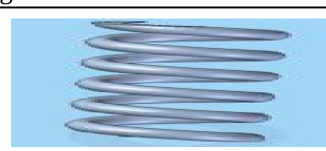

Fig no. 6 Spring

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E. Isolator : rubber (ams 3205) neoprene

Stiffness=0.01
(Assumed)
ω_n= 0.053 Rad/Sec

1) Length=125mm
2) Breadth=70mm
3) Thickness=50mm

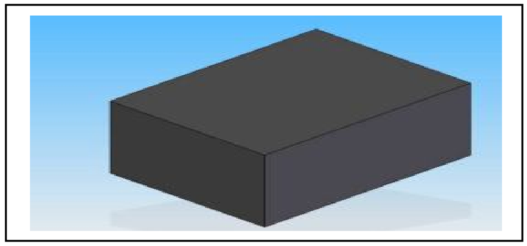

Fig no. 7 Rubber

F. Isolator : wood

Stiffness=0.02(Assumed)
ω_n = 0.076 Rad/Sec
Dimension
Length=122mm
Breadth=67mm
Thickness=45mm

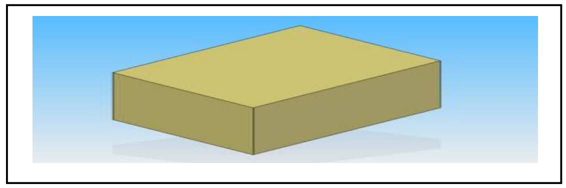

Fig no. 8 Wood block

G. Each isolator is fixed between two steel plate.

Steel Plate Length L_1=150mm L_2=150mm Area=L_1* L_2=150*150=22500mm^2
Number of plates used for each isolator =2
Total no of plates used for isolator =2*3(Isolator) =6

H. Base plate for assembly (motor+ isolator)

Material :- Cast Iron
Area =150*150=22500mm^2

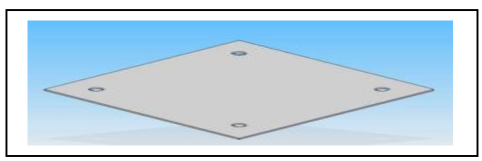

Fig no .9 Base plate

I. weighing machine :is used as loadcell.

Capacity: 30 kg

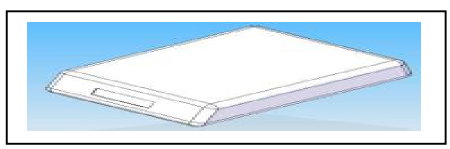

Fig no. 10 Weighing Machine

J. Stand- square bars
Length= 445mm
Breadth=250mm
Thickness=245mm

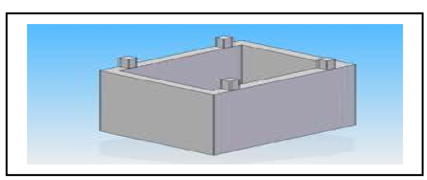

Fig no. 11 Stand

III. ANALYSIS OF ISOLATORS

In order to go for analysis it is necessary to give proper notations.Following are the notations used to deal with test rig
Let, Eccentric mass=m_0, Kg, Combined weight of motor and isolator =W(N), Natural frequency for isolator=ω_n, Eccentricity=e (m), Revolution of motor=n (rpm), Angular velocity of eccentric mass $\omega=(2\pi n)/60$, Centrifugal force due to eccentric mass CF=$m_0 e\omega^2$, Applied force=Fi=W+CF, Transmitted force=Ft, Transmissibility =Tr=Ft/Fi

A. Analysis of spring

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Table No.1 Spring Transmissibility for eccentricity 0.032m

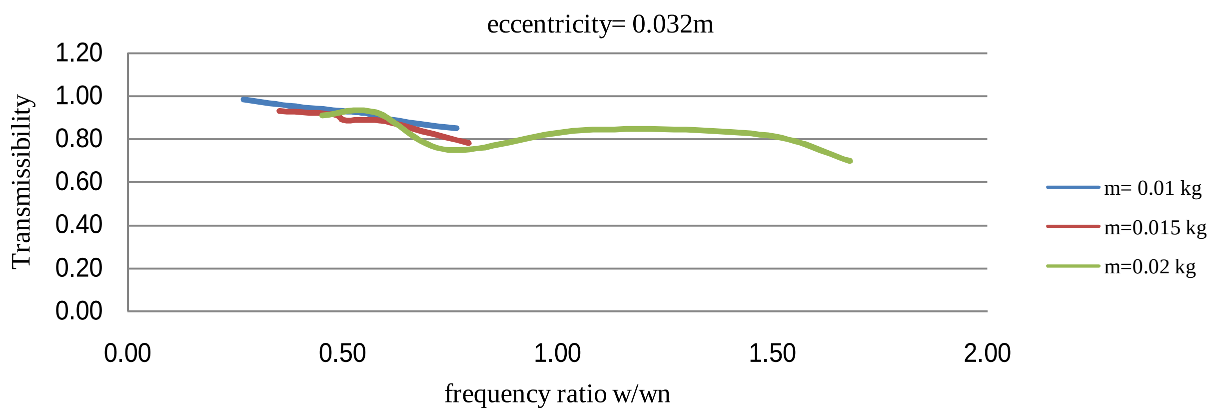
Reading No.	m0 (kg)	wt W(N)	ωn	e (m)	n (RPM)	ω=(2π n)/60	ω/ωn	C.F (N)=m0 *e*ω^2	Fi(N)= W+CF	Ft(kg)	Ft(N)	Tr=Ft /Fi
1	0.0100	34.11	178.00	0.032	460	48.15	0.27	0.74	34.85	3.50	34.34	0.99
2	0.0100	34.11	178.00	0.032	670	70.13	0.39	1.57	35.68	3.46	33.94	0.95
3	0.0100	34.11	178.00	0.032	939	98.28	0.55	3.09	37.20	3.49	34.24	0.92
4	0.0100	34.11	178.00	0.032	1000	104.67	0.59	3.51	37.62	3.45	33.86	0.90
5	0.0100	34.11	178.00	0.032	1150	120.37	0.68	4.64	38.75	3.44	33.75	0.87
6	0.0100	34.11	178.00	0.032	1300	136.07	0.76	5.92	40.03	3.47	34.02	0.85
1	0.0150	34.11	178.00	0.032	600	62.80	0.35	1.89	36.00	3.41	33.47	0.93
2	0.0150	34.11	178.00	0.032	820	85.83	0.48	3.54	37.65	3.50	34.35	0.91
3	0.0150	34.11	178.00	0.032	853	89.28	0.50	3.83	37.94	3.43	33.67	0.89
4	0.0150	34.11	178.00	0.032	1000	104.67	0.59	5.26	39.37	3.55	34.85	0.89
5	0.0150	34.11	178.00	0.032	1167	122.15	0.69	7.16	41.27	3.51	34.47	0.84
6	0.0150	34.11	178.00	0.032	1349	141.20	0.79	9.57	43.68	3.48	34.12	0.78
1	0.0200	34.11	178.00	0.032	770	80.59	0.45	4.16	38.27	3.55	34.83	0.91
2	0.0200	34.11	178.00	0.032	980	102.57	0.58	6.73	40.84	3.85	37.74	0.92
3	0.0200	34.11	178.00	0.032	1271	133.03	0.75	11.33	45.44	3.48	34.10	0.75
4	0.0200	34.11	178.00	0.032	1800	188.40	1.06	22.72	56.83	4.87	47.78	0.84
5	0.0200	34.11	178.00	0.032	2500	261.67	1.47	43.82	77.93	6.53	64.07	0.82
6	0.0200	34.11	178.00	0.032	2856	298.93	1.68	57.19	91.30	6.51	63.88	0.70

Table No 2 Spring Transmissibility for eccentricity 0.035m

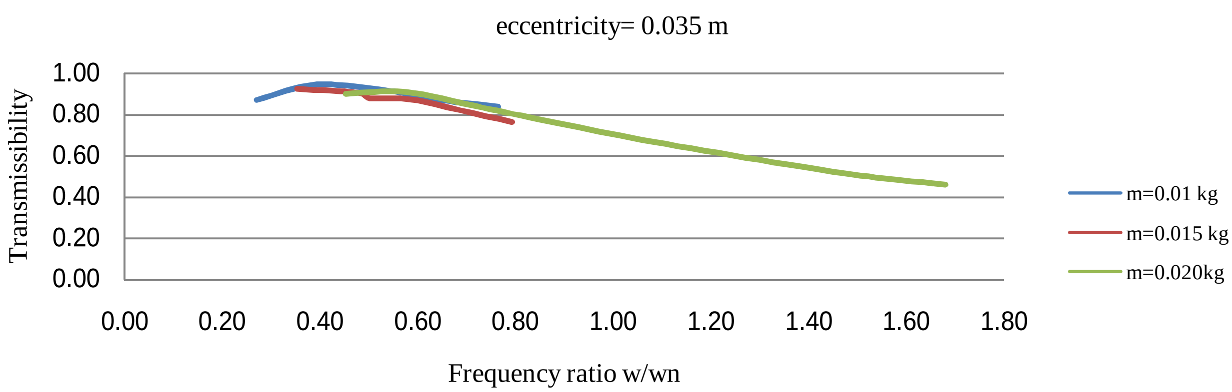
Reading No.	m0 (kg)	wt W(N)	ωn	e (m)	n (RPM)	ω=(2π n)/60	ω/ωn	C.F (N)=m0 *e*ω^2	Fi(N)= W+CF	Ft(kg)	Ft(N)	Tr=Ft /Fi
1	0.0100	34.11	178	0.035	460	48.15	0.27	0.81	34.92	3.10	30.41	0.87
2	0.0100	34.11	178	0.035	670	70.13	0.39	1.72	35.83	3.46	33.94	0.95
3	0.0100	34.11	178	0.035	939	98.28	0.55	3.38	37.49	3.49	34.24	0.91
4	0.0100	34.11	178	0.035	1000	104.67	0.59	3.83	37.94	3.45	33.86	0.89
5	0.0100	34.11	178	0.035	1150	120.37	0.68	5.07	39.18	3.44	33.75	0.86
6	0.0100	34.11	178	0.035	1300	136.07	0.76	6.48	40.59	3.47	34.02	0.84
1	0.0150	34.11	178	0.035	600	62.80	0.35	2.07	36.18	3.41	33.47	0.93
2	0.0150	34.11	178	0.035	820	85.83	0.48	3.87	37.98	3.50	34.35	0.90
3	0.0150	34.11	178	0.035	853	89.28	0.50	4.18	38.29	3.43	33.67	0.88
4	0.0150	34.11	178	0.035	1000	104.67	0.59	5.75	39.86	3.55	34.85	0.87
5	0.0150	34.11	178	0.035	1167	122.15	0.69	7.83	41.94	3.51	34.47	0.82
6	0.0150	34.11	178	0.035	1349	141.20	0.79	10.47	44.58	3.48	34.12	0.77
1	0.0200	34.11	178	0.035	770	80.59	0.45	4.55	38.66	3.55	34.83	0.90
2	0.0200	34.11	178	0.035	980	102.57	0.58	7.36	41.47	3.85	37.74	0.91
3	0.0200	34.11	178	0.035	1271	133.03	0.75	12.39	46.50	3.48	38.45	0.83
4	0.0200	34.11	178	0.035	1800	188.40	1.06	24.85	58.96	4.87	40.02	0.68
5	0.0200	34.11	178	0.035	2500	261.67	1.47	47.93	82.04	6.53	42.39	0.52
6	0.0200	34.11	178	0.035	2856	298.93	1.68	62.55	96.66	6.51	44.52	0.46

Table No 3 Spring Transmissibility for eccentricity 0.037m

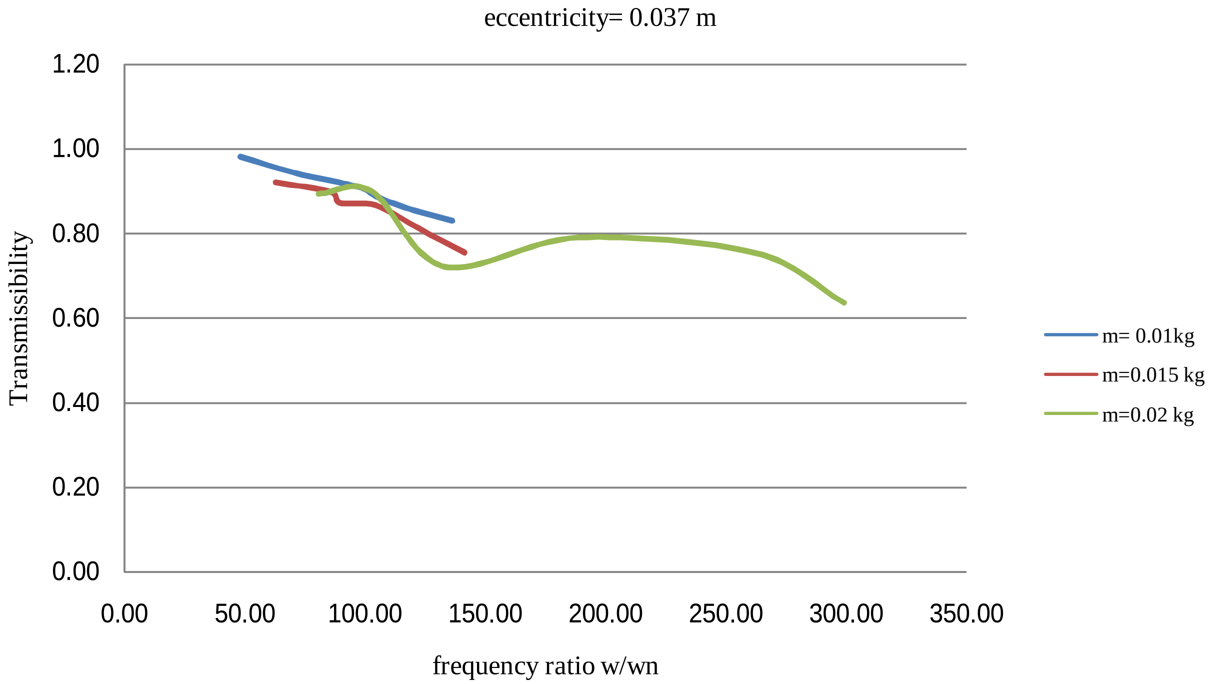
Reading No.	m0 (kg)	wt W(N)	ωn	e (m)	n (RPM)	ω=(2π n)/60	ω/ωn	C.F (N)=m0 *e*ω^2	Fi(N)= W+CF	Ft(kg)	Ft(N)	Tr=Ft/ Fi
1	0.0100	34.11	178.00	0.037	460.00	48.15	0.27	0.86	34.97	3.50	34.34	0.98
2	0.0100	34.11	178.00	0.037	670.00	70.13	0.39	1.82	35.93	3.46	33.94	0.94
3	0.0100	34.11	178.00	0.037	939.00	98.28	0.55	3.57	37.68	3.49	34.24	0.91
4	0.0100	34.11	178.00	0.037	1000.00	104.67	0.59	4.05	38.16	3.45	33.86	0.89
5	0.0100	34.11	178.00	0.037	1150.00	120.37	0.68	5.36	39.47	3.44	33.75	0.85
6	0.0100	34.11	178.00	0.037	1300.00	136.07	0.76	6.85	40.96	3.47	34.02	0.83
1	0.0150	34.11	178.00	0.037	600.00	62.80	0.35	2.19	36.30	3.41	33.47	0.92
2	0.0150	34.11	178.00	0.037	820.00	85.83	0.48	4.09	38.20	3.50	34.35	0.90
3	0.0150	34.11	178.00	0.037	853.00	89.28	0.50	4.42	38.53	3.43	33.67	0.87
4	0.0150	34.11	178.00	0.037	1000.00	104.67	0.59	6.08	40.19	3.55	34.85	0.87
5	0.0150	34.11	178.00	0.037	1167.00	122.15	0.69	8.28	42.39	3.51	34.47	0.81
6	0.0150	34.11	178.00	0.037	1349.00	141.20	0.79	11.06	45.17	3.48	34.12	0.76
1	0.0200	34.11	178.00	0.037	770.00	80.59	0.45	4.81	38.92	3.55	34.83	0.89
2	0.0200	34.11	178.00	0.037	980.00	102.57	0.58	7.79	41.90	3.85	37.74	0.90
3	0.0200	34.11	178.00	0.037	1271.00	133.03	0.75	13.10	47.21	3.48	34.10	0.72
4	0.0200	34.11	178.00	0.037	1800.00	188.40	1.06	26.27	60.38	4.87	47.78	0.79
5	0.0200	34.11	178.00	0.037	2500.00	261.67	1.47	50.67	84.78	6.53	64.07	0.76
6	0.0200	34.11	178.00	0.037	2856.00	298.93	1.68	66.12	100.23	6.51	63.88	0.64



Graph 1 Spring Transmissibility for eccentricity 0.032m



Graph 2 Spring Transmissibility for eccentricity 0.035m



Graph 3 Spring Transmissibility for eccentricity 0.037m

B. Analysis of rubber

Table No.4 Rubber Transmissibility for eccentricity 0.032m

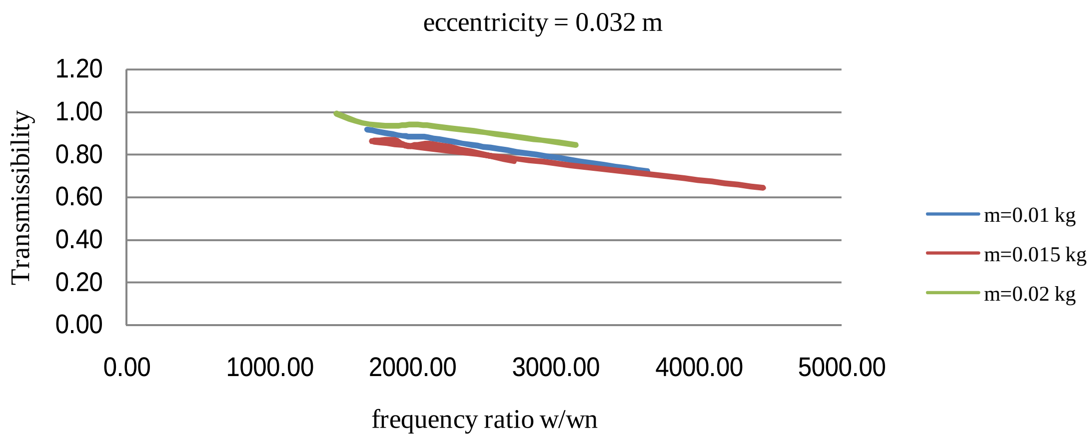
Reading No.	m0 (kg)	wt W(N)	ωn	e (m)	n (RPM)	ω=(2πn)/60	ω/ωn	C.F (N)=m0*e*ω^2	Fi(N)= W+CF	Ft(kg)	Ft(N)	Tr=Ft/Fi
1	0.0100	34.82	0.053	0.032	850	88.97	1678.62	2.53	37.35	3.50	34.34	0.92
2	0.0100	34.82	0.053	0.032	987	103.31	1949.17	3.42	38.24	3.46	33.94	0.89
3	0.0100	34.82	0.053	0.032	1051	110.00	2075.56	3.87	38.69	3.49	34.24	0.88
4	0.0100	34.82	0.053	0.032	1260	131.88	2488.30	5.57	40.39	3.45	33.86	0.84
5	0.0100	34.82	0.053	0.032	1843	192.90	3639.64	11.91	46.73	3.44	33.75	0.72
6	0.0100	34.82	0.053	0.032	2252	235.71	4447.35	17.78	52.60	3.47	34.02	0.65
1	0.0150	34.82	0.053	0.032	874	91.48	1726.01	4.02	38.84	3.41	33.47	0.86
2	0.0150	34.82	0.053	0.032	945	98.91	1866.23	4.70	39.52	3.50	34.35	0.87
3	0.0150	34.82	0.053	0.032	995	104.14	1964.97	5.21	40.03	3.43	33.67	0.84
4	0.0150	34.82	0.053	0.032	1086	113.67	2144.68	6.20	41.02	3.55	34.85	0.85
5	0.0150	34.82	0.053	0.032	1370	143.39	2705.53	9.87	44.69	3.51	34.47	0.77
6	0.0150	34.82	0.053	0.032	1681	175.94	3319.71	14.86	49.68	3.48	34.12	0.69
1	0.0200	34.82	0.053	0.032	743	77.77	1467.31	3.87	38.69	3.92	38.46	0.99
2	0.0200	34.82	0.053	0.032	835	87.40	1648.99	4.89	39.71	3.85	37.74	0.95
3	0.0200	34.82	0.053	0.032	943	98.70	1862.28	6.23	41.05	3.48	38.45	0.94
4	0.0200	34.82	0.053	0.032	1050	109.90	2073.58	7.73	42.55	4.87	40.02	0.94
5	0.0200	34.82	0.053	0.032	1345	140.78	2656.16	12.68	47.50	6.53	42.39	0.89
6	0.0200	34.82	0.053	0.032	1590	166.42	3140.00	17.73	52.55	6.51	44.52	0.85

Table No.5 Rubber Transmissibility for eccentricity 0.035m

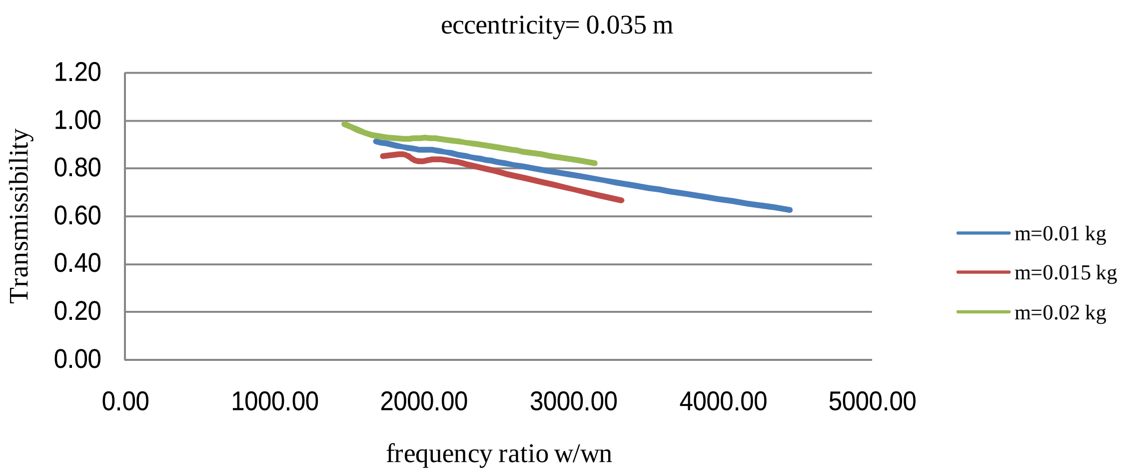
Reading No.	m0 (kg)	wt W(N)	ωn	e (m)	n (RPM)	ω=(2πn)/60	ω/ωn	C.F (N)=m0 *e*ω^2	Fi(N)= W+CF	Ft(kg)	Ft(N)	Tr=Ft/Fi
1	0.0100	34.82	0.053	0.035	850	88.97	1678.62	2.77	37.59	3.50	34.34	0.91
2	0.0100	34.82	0.053	0.035	987	103.31	1949.17	3.74	38.56	3.46	33.94	0.88
3	0.0100	34.82	0.053	0.035	1051	110.00	2075.56	4.24	39.06	3.49	34.24	0.88
4	0.0100	34.82	0.053	0.035	1260	131.88	2488.30	6.09	40.91	3.45	33.86	0.83
5	0.0100	34.82	0.053	0.035	1843	192.90	3639.64	13.02	47.84	3.44	33.75	0.71
6	0.0100	34.82	0.053	0.035	2252	235.71	4447.35	19.45	54.27	3.47	34.02	0.63
1	0.0150	34.82	0.053	0.035	874	91.48	1726.01	4.39	39.21	3.41	33.47	0.85
2	0.0150	34.82	0.053	0.035	945	98.91	1866.23	5.14	39.96	3.50	34.35	0.86
3	0.0150	34.82	0.053	0.035	995	104.14	1964.97	5.69	40.51	3.43	33.67	0.83
4	0.0150	34.82	0.053	0.035	1086	113.67	2144.68	6.78	41.60	3.55	34.85	0.84
5	0.0150	34.82	0.053	0.035	1370	143.39	2705.53	10.79	45.61	3.51	34.47	0.76
6	0.0150	34.82	0.053	0.035	1681	175.94	3319.71	16.25	51.07	3.48	34.12	0.67
1	0.0200	34.82	0.053	0.035	743	77.77	1467.31	4.23	39.05	3.92	38.46	0.98
2	0.0200	34.82	0.053	0.035	835	87.40	1648.99	5.35	40.17	3.85	37.74	0.94
3	0.0200	34.82	0.053	0.035	943	98.70	1862.28	6.82	41.64	3.48	38.45	0.92
4	0.0200	34.82	0.053	0.035	1050	109.90	2073.58	8.45	43.27	4.87	40.02	0.92
5	0.0200	34.82	0.053	0.035	1345	140.78	2656.16	13.87	48.69	6.53	42.39	0.87
6	0.0200	34.82	0.053	0.035	1590	166.42	3140.00	19.39	54.21	6.51	44.52	0.82

Table No.6 Rubber Transmissibility for eccentricity 0.037m

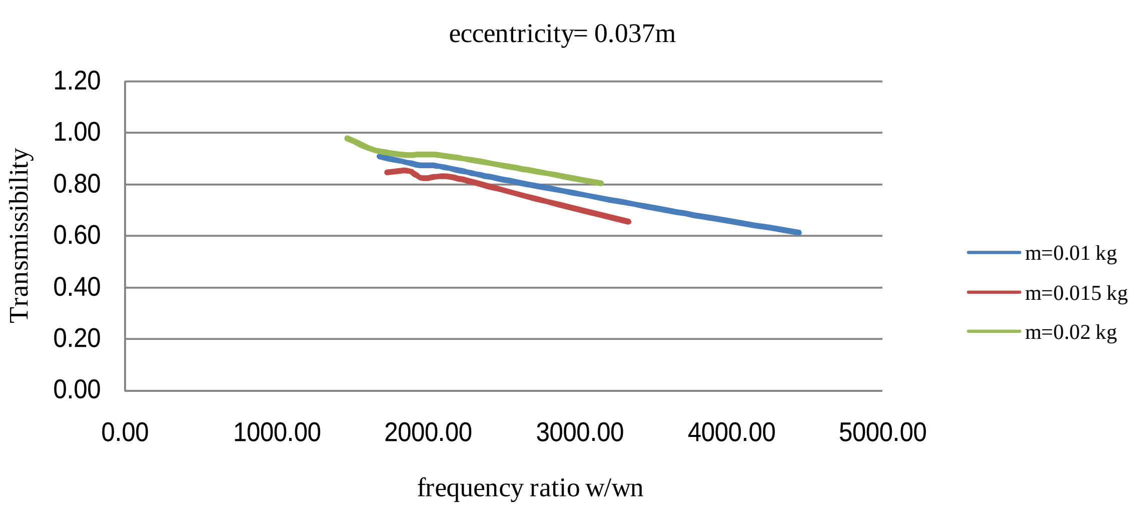
Reading No.	m0 (kg)	wt W(N)	ωn	e (m)	n (RPM)	ω=(2πn)/60	ω/ωn	C.F (N)=m0 *e*ω^2	Fi(N)= W+CF	Ft(kg)	Ft(N)	Tr=Ft/Fi
1	0.0100	34.82	0.053	0.037	850	88.97	1678.62	2.93	37.75	3.50	34.34	0.91
2	0.0100	34.82	0.053	0.037	987	103.31	1949.17	3.95	38.77	3.46	33.94	0.88
3	0.0100	34.82	0.053	0.037	1051	110.00	2075.56	4.48	39.30	3.49	34.24	0.87
4	0.0100	34.82	0.053	0.037	1260	131.88	2488.30	6.44	41.26	3.45	33.86	0.82
5	0.0100	34.82	0.053	0.037	1843	192.90	3639.64	13.77	48.59	3.44	33.75	0.69
6	0.0100	34.82	0.053	0.037	2252	235.71	4447.35	20.56	55.38	3.47	34.02	0.61
1	0.0150	34.82	0.053	0.037	874	91.48	1726.01	4.64	39.46	3.41	33.47	0.85
2	0.0150	34.82	0.053	0.037	945	98.91	1866.23	5.43	40.25	3.50	34.35	0.85
3	0.0150	34.82	0.053	0.037	995	104.14	1964.97	6.02	40.84	3.43	33.67	0.82
4	0.0150	34.82	0.053	0.037	1086	113.67	2144.68	7.17	41.99	3.55	34.85	0.83
5	0.0150	34.82	0.053	0.037	1370	143.39	2705.53	11.41	46.23	3.51	34.47	0.75
6	0.0150	34.82	0.053	0.037	1681	175.94	3319.71	17.18	52.00	3.48	34.12	0.66
1	0.0200	34.82	0.053	0.037	743	77.77	1467.31	4.48	39.30	3.92	38.46	0.98
2	0.0200	34.82	0.053	0.037	835	87.40	1648.99	5.65	40.47	3.85	37.74	0.93
3	0.0200	34.82	0.053	0.037	943	98.70	1862.28	7.21	42.03	3.48	38.45	0.91
4	0.0200	34.82	0.053	0.037	1050	109.90	2073.58	8.94	43.76	4.87	40.02	0.91
5	0.0200	34.82	0.053	0.037	1345	140.78	2656.16	14.67	49.49	6.53	42.39	0.86
6	0.0200	34.82	0.053	0.037	1590	166.42	3140.00	20.49	55.31	6.51	44.52	0.80



Graph 4 Rubber Transmissibility for eccentricity 0.032m



Graph.5 Rubber Transmissibility for eccentricity 0.035m



Graph 6 Rubber Transmissibility for eccentricity 0.037m

C. Analysis of wood

Table No.7 Wood Transmissibility for eccentricity 0.032m

Reading No.	m0 (kg)	wt W(N)	ωn	e (m)	n (RPM)	ω=(2πn)/60	ω/ωn	C.F (N)=m0*e*ω^2	Fi(N)= W+CF	Ft(kg)	Ft(N)	Tr=Ft/Fi
1	0.0100	33.29	0.076	0.032	952	99.64	1311.09	3.18	36.47	3.50	34.34	0.94
2	0.0100	33.29	0.076	0.032	1000	104.67	1377.19	3.51	36.80	3.46	33.94	0.92
3	0.0100	33.29	0.076	0.032	1265	132.40	1742.15	5.61	38.90	3.49	34.24	0.88
4	0.0100	33.29	0.076	0.032	1320	138.16	1817.89	6.11	39.40	3.45	33.86	0.86
5	0.0100	33.29	0.076	0.032	1518	158.88	2090.58	8.08	41.37	3.44	33.75	0.82
6	0.0100	33.29	0.076	0.032	1729	180.97	2381.17	10.48	43.77	3.47	34.02	0.78
1	0.0150	33.29	0.076	0.032	833	87.19	1147.20	3.65	36.94	3.41	33.47	0.91
2	0.0150	33.29	0.076	0.032	996	104.25	1371.68	5.22	38.51	3.50	34.35	0.89
3	0.0150	33.29	0.076	0.032	1100	115.13	1514.91	6.36	39.65	3.43	33.67	0.85
4	0.0150	33.29	0.076	0.032	1380	144.44	1900.53	10.01	43.30	3.55	34.85	0.80
5	0.0150	33.29	0.076	0.032	1600	167.47	2203.51	13.46	46.75	3.51	34.47	0.74
6	0.0150	33.29	0.076	0.032	1724	180.45	2374.28	15.63	48.92	3.48	34.12	0.70
1	0.0200	33.29	0.076	0.032	887	92.84	1221.57	5.52	38.81	3.92	38.46	0.99
2	0.0200	33.29	0.076	0.032	923	96.61	1271.15	5.97	39.26	3.85	37.74	0.96
3	0.0200	33.29	0.076	0.032	1040	108.85	1432.28	7.58	40.87	3.48	38.45	0.94
4	0.0200	33.29	0.076	0.032	1230	128.74	1693.95	10.61	43.90	4.87	40.02	0.91
5	0.0200	33.29	0.076	0.032	1416	148.21	1950.11	14.06	47.35	6.53	42.39	0.90
6	0.0200	33.29	0.076	0.032	1500	157.00	2065.79	15.78	49.07	6.51	44.52	0.91

Table No.8 Wood Transmissibility for eccentricity 0.035m

Reading No.	m0 (kg)	wt W(N)	ωn	e (m)	n (RPM)	ω=(2πn)/60	ω/ωn	C.F (N)=m0*e*ω^2	Fi(N)=W+CF	Ft(kg)	Ft(N)	Tr=Ft/Fi
1	0.0100	33.29	0.076	0.035	952	99.64	1311.09	3.48	36.77	3.50	34.34	0.93
2	0.0100	33.29	0.076	0.035	1000	104.67	1377.19	3.83	37.12	3.46	33.94	0.91
3	0.0100	33.29	0.076	0.035	1265	132.40	1742.15	6.14	39.43	3.49	34.24	0.87
4	0.0100	33.29	0.076	0.035	1320	138.16	1817.89	6.68	39.97	3.45	33.86	0.85
5	0.0100	33.29	0.076	0.035	1518	158.88	2090.58	8.84	42.13	3.44	33.75	0.80
6	0.0100	33.29	0.076	0.035	1729	180.97	2381.17	11.46	44.75	3.47	34.02	0.76
1	0.0150	33.29	0.076	0.035	833	87.19	1147.20	3.99	37.28	3.41	33.47	0.90
2	0.0150	33.29	0.076	0.035	996	104.25	1371.68	5.71	39.00	3.50	34.35	0.88
3	0.0150	33.29	0.076	0.035	1100	115.13	1514.91	6.96	40.25	3.43	33.67	0.84
4	0.0150	33.29	0.076	0.035	1380	144.44	1900.53	10.95	44.24	3.55	34.85	0.79
5	0.0150	33.29	0.076	0.035	1600	167.47	2203.51	14.72	48.01	3.51	34.47	0.72
6	0.0150	33.29	0.076	0.035	1724	180.45	2374.28	17.09	50.38	3.48	34.12	0.68
1	0.0200	33.29	0.076	0.035	887	92.84	1221.57	6.03	39.32	3.92	38.46	0.98
2	0.0200	33.29	0.076	0.035	923	96.61	1271.15	6.53	39.82	3.85	37.74	0.95
3	0.0200	33.29	0.076	0.035	1040	108.85	1432.28	8.29	41.58	3.48	38.45	0.92
4	0.0200	33.29	0.076	0.035	1230	128.74	1693.95	11.60	44.89	4.87	40.02	0.89
5	0.0200	33.29	0.076	0.035	1416	148.21	1950.11	15.38	48.67	6.53	42.39	0.87
6	0.0200	33.29	0.076	0.035	1500	157.00	2065.79	17.25	50.54	6.51	44.52	0.88

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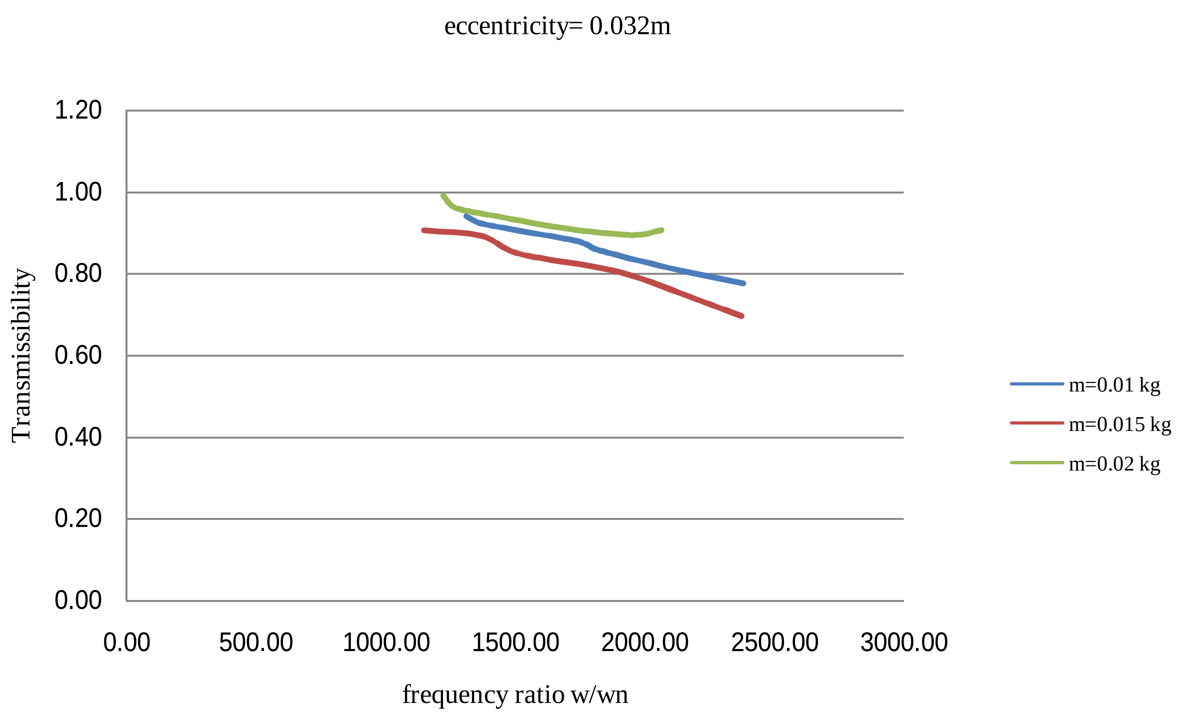
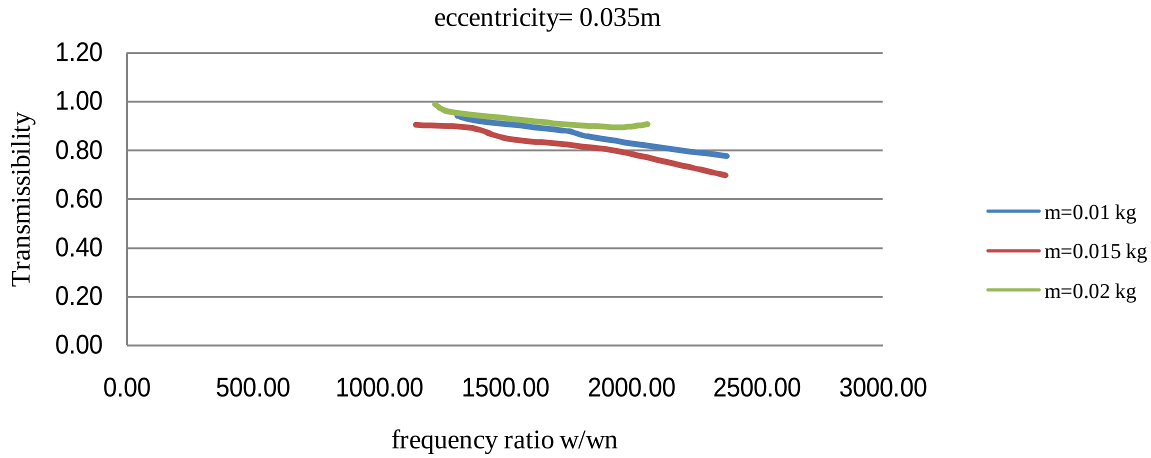
Table No.9 Wood Transmissibility for eccentricity 0.037m

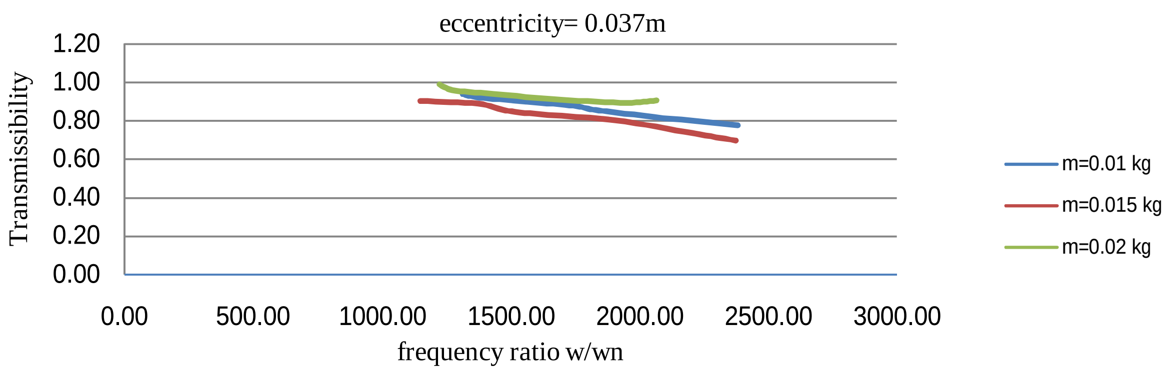
Reading No.	m0 (kg)	wt W(N)	ωn	e (m)	n (RPM)	ω=(2πn)/60	ω/ωn	C.F (N)=m0*e*ω^2	Fi(N)= W+CF	Ft(kg)	Ft(N)	Tr=Ft/Fi
1	0.0100	33.29	0.076	0.037	952	99.64	1311.09	3.67	36.96	3.50	34.34	0.93
2	0.0100	33.29	0.076	0.037	1000	104.67	1377.19	4.05	37.34	3.46	33.94	0.91
3	0.0100	33.29	0.076	0.037	1265	132.40	1742.15	6.49	39.78	3.49	34.24	0.86
4	0.0100	33.29	0.076	0.037	1320	138.16	1817.89	7.06	40.35	3.45	33.86	0.84
5	0.0100	33.29	0.076	0.037	1518	158.88	2090.58	9.34	42.63	3.44	33.75	0.79
6	0.0100	33.29	0.076	0.037	1729	180.97	2381.17	12.12	45.41	3.47	34.02	0.75
1	0.0150	33.29	0.076	0.037	833	87.19	1147.20	4.22	37.51	3.41	33.47	0.89
2	0.0150	33.29	0.076	0.037	996	104.25	1371.68	6.03	39.32	3.50	34.35	0.87
3	0.0150	33.29	0.076	0.037	1100	115.13	1514.91	7.36	40.65	3.43	33.67	0.83
4	0.0150	33.29	0.076	0.037	1380	144.44	1900.53	11.58	44.87	3.55	34.85	0.78
5	0.0150	33.29	0.076	0.037	1600	167.47	2203.51	15.57	48.86	3.51	34.47	0.71
6	0.0150	33.29	0.076	0.037	1724	180.45	2374.28	18.07	51.36	3.48	34.12	0.66
1	0.0200	33.29	0.076	0.037	887	92.84	1221.57	6.38	39.67	3.92	38.46	0.97
2	0.0200	33.29	0.076	0.037	923	96.61	1271.15	6.91	40.20	3.85	37.74	0.94
3	0.0200	33.29	0.076	0.037	1040	108.85	1432.28	8.77	42.06	3.48	38.45	0.91
4	0.0200	33.29	0.076	0.037	1230	128.74	1693.95	12.26	45.55	4.87	40.02	0.88
5	0.0200	33.29	0.076	0.037	1416	148.21	1950.11	16.25	49.54	6.53	42.39	0.86
6	0.0200	33.29	0.076	0.037	1500	157.00	2065.79	18.24	51.53	6.51	44.52	0.86



Graph 7 Wood Transmissibility for eccentricity 0.032m



Graph 8 Wood Transmissibility for eccentricity 0.035m



Graph 7 Wood Transmissibility for eccentricity 0.037m

IV. CONCLUSION

The force transmissibility of different isolator are calculated by using load cell (weighing machine). Hence from graphical representation results are obtained.

A. As frequency of dynamic vibration increases, torque transmissibility decreases.
B. For all type types of isolating materials result shows value of transmissibility is lower than one it means that all the time transmitted force is less than impressed force.
C. As rotating masses increases from 10gm to 20 gm and frequency of vibration increases ultimately result in decreasing transmissibility in spring, rubber and wood isolation.
D. For spring, rubber and wood, the graph frequency ratio increases, transmissibility decreases. Transmissibility of spring, rubber and wood Tr<1.
E. Transmissibility decreases with increasing order of frequency due to dynamic vibration using rubber as a isolation material. It concludes that rubber isolator gives best transmissibility.

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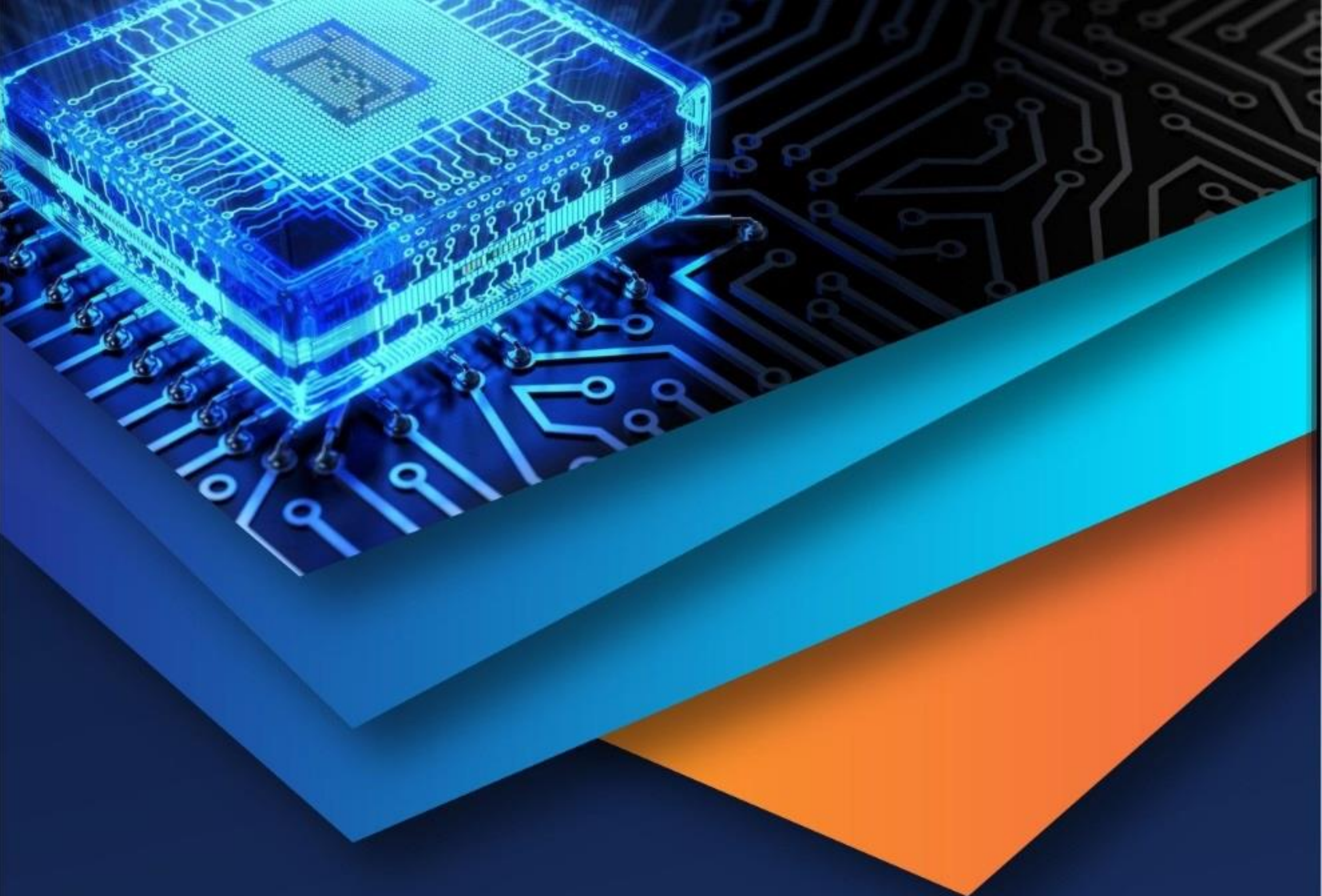

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