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Analysis of Torque Convertor Using Two Masses for Medium Duty Vehicles

Rajesh K. Narhire[1], L. B. Raut[2]
[1]*ME Student, Mechanical Engineering (CAD/CAM), SVERI College of Engineering, Pandharpur.*
[2]*Assistant Professor, Mechanical Engineering, SVERI College of Engineering, Pandharpur.*
Solapur University, Solapur, (India)

ABSTRACT: *A mechanical torque converting transmission producing an output with variable controllable speed torque characteristics which compares a rotary input shaft adapted for attachment to the rotary power source connected to a main shaft. This invention relates to a mechanism transferring torque from one rotating shaft to another and in particular to a transmission mechanism that will enable an engine or motor to deliver power to a load at optimum torque and speed levels. Control can be utilize to activate or deactivate the clutch also change the phase relationship of the driven eccentric masses device in order to vary the transmission output under varying load condition. Infinitely variable transmission system plays a crucial role in order to guarantee the overall vehicle performance in different working conditions. The relationship between the stress and transmission which is based on the results of two different mass strategies with dynamometer and motor is constructed to test the transmission to speed the results of those tests which shows the efficient at low input torque levels. A virtual verification process is described focusing on the model based engineering which allows reducing the number of prototypes and hence lower cost and development time.*

Keywords - *Infinitely Variable Transmission, Novel Cam, Velocity Theorem, Positive Drive.*

I. INTRODUCTION

The purpose of this design project was to improve upon an existing infinitely variable transmission design for use in Automobile. An infinitely variable transmission is a new design of transmission which utilizes moments produced by rotating offset masses to transfer torque, while varying output speed, from the engine to the output shaft. In an effort to design a reliable and efficient infinitely variable transmission, all components from the existing infinitely variable transmission were analyzed in detail and modified accordingly.

The linear IVT is solving the problem in modern automobile industry to develop new generation in vehicle to sustain. The input and output ratio in traction the linear IVT parameters to sustain the limited Two masses profile and masses the IVT infinity check the depending upon various load condition in gear, clutch, Two masses and Two masses follower. The superior in automobile cycle, the linear IVT dissolve input speed to the shaft traction to the output shaft to the transmission solver transmission ratio. The different investigators presents the background and theory related to the IVT, considers alternative designs, and presents the final design. It also outlines improvements for the IVT which will be installed in automobiles.

A two masses-based infinitely variable transmission system allows a user to vary the speed between input & output progressively from one positive value to another. Unlike, conventional transmissions the selection of gears is not restricted to a finite number of ratios. The two masses-based infinitely variable transmission systems can be used in automobile drive applications to improve performance, economy & functionality.

II. OBJECTIVE OF PROJECT

1. To Design & Development of Infinitely variable transmission based on Torque convertor mechanism
2. Testing and Trial To derive the following performance characteristics :
   a) Torque Vs Speed
   b) Output Power Vs Speed
   c) Efficiency Vs Speed.
3. Manufacturing of torque convertor using IVT system

III. RESEARCH METHODOLOGY

1. Review of literature regarding the work done.
2. Analytical design of IVT.
3. Manufacturing and assembly of the Actual testing set-up.
4. Perform experimental testing on IVT with different two masses.
5. Result and Discussion.

IV. ANALYTICAL ANALYSIS

4.1 Design of Mass-01:

The mass -01 is a link that is subjected to direct tensile load in the form of pull = 48 N material selection

Table 1: Mass No.1 Material

Material Designation	Tensile Strength (N/mm^2)	Yield Strength (N/mm^2)
EN9	600	380

Check for failure of mass under direct tensile load at the eye end. This is the portion where the lever pin fits, the cross sectional area at this point is 288 mm2 now

FT = LOAD /AREA

Ft act = 48/288

= 0.166/mm^2

AS FT ACT < FT ALL

The link is safe under tensile load

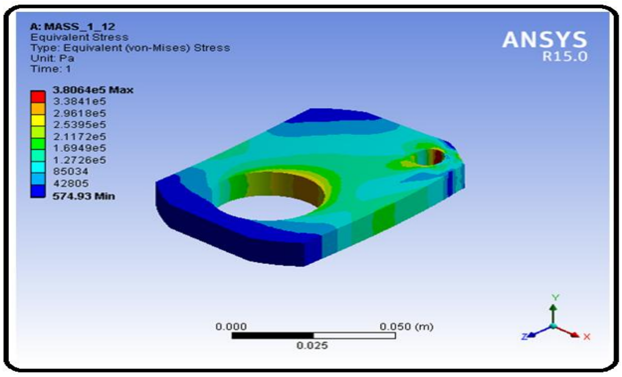


Fig. 1: FEA Analysis of Mass No-1

Table 2: FEA Results Mass No. 1

Sr. No	Thickness (mm)	Deformation (m)	Stress (Max) N/m^2
1	4	3.1398*10-7	1.1923
2	6	2.0927*10-7	8.246
3	8	1.5693*10-7	5.896
4	10	1.2553*10-7	4.811
5	12	1.0456*10-7	3.8064

4.2 Design of Mass-02:

The mass -02 is a link that is subjected to direct tensile load in the form of pull = 48 N Material Selection:

Table 3: Mass No.2 Material

Material Designation	Tensile Strength (N/mm^2)	Yield Strength (N/mm^2)
EN9	600	380

Check for failure of mass under direct tensile load at the eye end. This is the portion where the lever pin fits, the cross sectional area at this point is 576 mm2 now

FT = LOAD /AREA

$$Ft\ act = 48/576 = 0.0833\ N/mm^2$$

AS FT ACT < FT ALL

The Mass Number-2 is safe under tensile load.

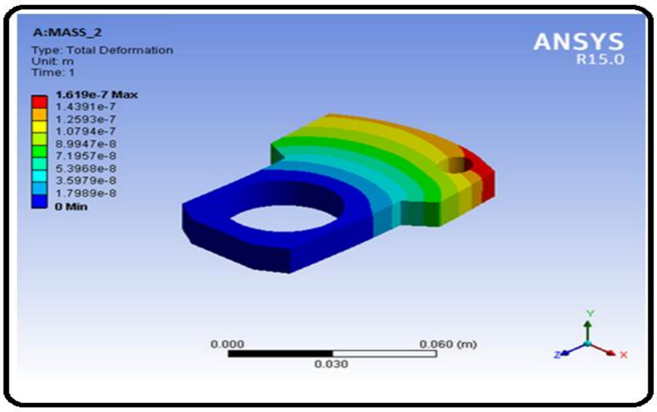


Fig.2: FEA Analysis Mass No.2

Table 4: FEA Results Mass No.2

Sr. No	Thickness (mm)	Deformation (m)	Stress (Max) N/m^2
1	4	4.8732*10-7	1.4766
2	6	3.248*10-7	0.5983
3	8	2.429*10-7	0.72404
4	10	1.944*10-7	0.57489
5	12	1.619*10-7	0.48529

4.3 Analytical results:

The maximum torque is given by the formula:

$$\mathbf{T = m * \omega^2 * R_{CG} * D_{(lobe\ offset)}} \quad \ldots\ldots\ldots\ldots (1)$$

Where,

T	:	Maximum torque (N-m)
m	:	Masse (kg)
ω^2	:	Angular acceleration (m/s^2)
R_{CG}	:	Radius of offset mass
$D_{(lobe\ offset)}$	:	Radius of lobe

Table 5: Analytical results

Sr. No	Speed	Angular Speed		Torque
	(rpm)	(w)	(w^2)	(N-m)
1	380	39.79	1583.4	0.10
2	520	54.45	2965	0.18
3	535	56.02	3138.6	0.19
4	650	68.07	4632.9	0.28
5	850	89.01	7922.6	0.48
6	1050	109.9	12089.5	0.73

V. EXPERIMENTAL RESULTS

The following test results will be derived from the test and trial on IVT Drive.

Table 6: Experimental Results

Sr. No	Weight	Radius of Pulley	Speed	Angular speed	Torque
	(kg)	(m)	(rpm)	(w)	(N-m)
1	0.1	0.0375	2100	219.905	0.037
2	0.15	0.0375	1960	205.245	0.055
3	0.2	0.0375	1750	183.254	0.074
4	0.25	0.0375	1600	167.547	0.092
5	0.3	0.0375	1250	130.896	0.110
6	0.35	0.0375	1050	109.953	0.129
7	0.5	0.0375	810	84.8205	0.184
8	0.6	0.0375	650	68.0658	0.221
9	0.7	0.0375	535	56.0234	0.258
10	0.8	0.0375	520	54.4527	0.294
11	1	0.0375	380	39.7923	0.368

VI. SUMMARY OF RESULT

The result correlation summarized as show in table 7

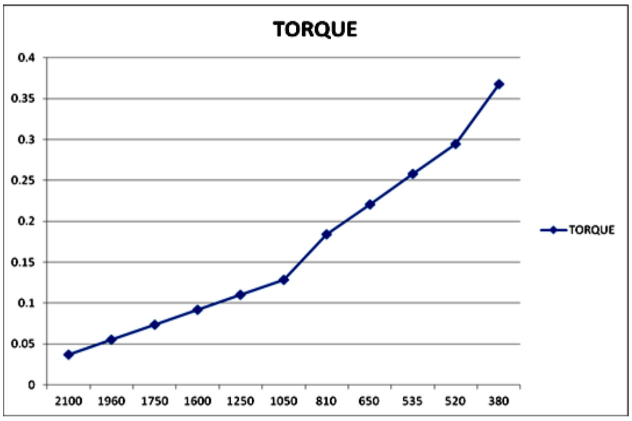
Table 7: Summary of result correlation

Sr.No	Speed	Analytical Results Torque (N-m)	Experimental results Torque (N-m)	% error
1	650	0.2793	0.2207	5
2	535	0.1892	0.2575	6
3	520	0.1787	0.2800	10

The error in prediction of IVT by theoretical analysis is the range of 3 to 4% and experimental analysis 5 to 20%. The propose method is confirmed by the comparing it with result of FEA and Experimental result. This is a in well agreement the acceptable limit ±10%.

1] Torque Vs Speed Characteristics:

The following test results will be derived from the test and trial on IVT Drive:



Graph No: 1. Torque Vs Speed Characteristics

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VIII. CONCLUSION

The IVT is infinity variable transmission of input speed to the output speed in torque convert ratio will be change. In two masses like Rectangular shape, irregular shape, the input shaft given the specific speed motor to the output result is varying different masses to determine torque converter by the Infinitely Variable Transmission (IVT). The speed difference ratios are design criteria of IVT and development in torque in the mass moment and convert different masses in linear speed.

The error in prediction of torque converter by theoretical analysis is in the range of 3 % to 15% and experimental analysis it is the range of 5 % to 20 %. The proposed method is confirmed by comparing it with results of FEA results and experimental results. The proposed method is found to be simple and accurate. The IVT is newly concept in Light and Medium vehicle on automobile industries is development research they are torque convertor in various masses with different input speed to very output speed to give the more efficient in output power.

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