DEGREE IN MECHANICS

FINAL DEGREE PROJECT

DESIGN OF THE TRANSMISSION OF A CAR

SUMMARY

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SUMMARY

1. OBJECTIVE OF THE PROJECT

The main objective of this project is to carry out the calculations and the mechanical design of a transmission of a car, more accurately the transmission for a BMW 1 series 118d. The transmission is an indispensable system when talking about a car. This is responsible for moving the torque created by the engine to the driving wheels of the car.

Following the technical specifications of the manufacturer, the engine has a nominal duty of 143 CV (105 kW) at 4000 rpm.

Based on the dimensions and operating conditions and taking into account the existing standards will be carried out the characteristics and calculations necessary to design the mechanical elements of the transmission. An attempt will be made to optimize the manufacturing and the maintenance cost of the previous elements using as far as possible the standardized elements and measures.

Image 1: BMW 1 series 118d car

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2. INITIAL DATA

BMW 1 series 118d	
Type of motor	4 cylinder diesel engine
Engine position	Longitudinal forward
Cylinder capacity	1995 cc
Power	143 CV (105kW) / 4000 rpm
Maximum torque	320 Nm / 2500 rpm
Gearbox	Manual, 6 gears
Traction	Rear
Maximum speed	224 Km/h
Acceleration (0-100 Km/h)	8,9 s
Weight	1395 Kg
Maximum mass	1850 Kg
Wheels	195 55 R16 87H

Table 1: initial data

TRANSMISSION RATIO (ω_m/ω_r)	
1º Gear	4,002:1
2º Gear	2,109:1
3º Gear	1,38:1
4º Gear	1:1
5º Gear	0,781:1
6º Gear	0,645:1
Reverse gear	3,647:1
Differential	3,077:1

Table 2: transmission ratio

3. CALCULATIONS

First there are calculated the resistant forces that the car has to support at the time of circulating. The resistant forces that have impact in the car are the following ones: resistance for rolling, earring, inertia and finally of the air. The renowned forces obstruct the movement of the car and it is necessary to be proved that the last one is capable of conquering these forces, and this way of circulating

Later the calculation of the clutch is realized, the clutch gathers the resistant torque of the engine and the clutch is in charge of transmitting it to the gearbox. With the maximum turning moment necessary radios for the disc of the clutch are obtained, since this debit to transmit a quite big pair, must be one with the axis. This is obtained by a grooved DIN 5480, thus the primary axis and the disc of clutch act like a only element.

It follows with the design of the gearbox, there takes as a starting point the information facilitated by the manufacturer of the motorcar. With the transmissions ratios they are calculated in number of teeth of every. The distance between axes of the wheels has been supposed constantly to avoid problems and also to reduce the corrections, for it there has been supposed the module and the angle of helix equal in all the wheels. Later the necessary module for every wheel is calculated, for it there is used the pine nut kernel of every pair of gear assembly, the biggest module is used for all the wheels. With the studied module of the wheels one proceeds to calculate the dimensions of the wheels and also the forces that each of them generates. In every pair of gear assembly, the forces generated in two wheels are of the same value but in the opposite direction. With the obtained forces an approximate sizing of the shafts is realized, the moments of diagram are obtained and there are calculated the forces that are generated in every point of support of every shaft. Finally by means of the code ASME the necessary minimal diameters are obtained in every section of the shafts. To finish with gearbox the bearing necessary for every support is calculated.

Later one proceeds to calculate the transmission tree, this element transmit the pair from the gearbox up to the differential. Bearing in mind the maximum pair and the maximum angular speed that it must support the most suitable section is chosen. Finally the section chosen is verified by code ASME and also the vibrations to verify that it doesn´t enter resonance.

To finish with the transmission system, the calculation of the differential would be missing, the last one is in charge of reducing the rotation and transmitting the pair to the drive wheels of the vehicle. Also it allows speed difference in wheels of the same axis. The calculation and design of this element is left in hands of another company, which devotes itself to realize conical cogwheels.

4. PLANS

In this Project have been developed the plans of the elements named above which make up the transmission of the automobile.

4. PLANS

5. BUDGET

Across the prices picture there is obtained the budget of the materials and manufacture. It is necessary to add to this budget other elements necessary for the execution of the project as commercial pieces and complementary expenses, thus there is obtained the budget of the materials and manufacture. Finally it is necessary to realise the execution budget and bearing in mind the remuneration the entire budget of the project is obtained.

The different parts that complete the entire budget of the project are the following ones:

(Materials and manufacture)……………………………………………………....2981,59 €

Execution budget……..…………………..………………………………………....5168,41 €

Remuneration……………....…………………………………………………....…..1850 €

ENTIRE BUDGET……………………………………………....…....……**7018,41 €**

THE ENTIRE COST OF THE BUDGET IS: SEVEN THOUSAND EIGHTEEN WITH FORTY ONE CENTS.

6. BIBLIOGRAPHY

To develop the Project these are some of the most important information sources that have been used.

BOOKS

- ÁGUEDA, E., MARTÍN, J. eta GÓMEZ, T. "Sistemas de transmisión y frenado".Editorial Paraninfo. Madrid, 2011.

- BUDYNAS, R. eta NISBETT, J. "Diseño de Ingeniería Mecánica de Shigley". Editorial McGraw Hill. Madrid, 2008.

- CASCAJOSA, M. "Ingeniería de vehículos". Editorial Tébar. Madrid, 2008.

- FAIRES, V. M. "Diseño de elementos de máquinas". Editorial Montaner y Simón. Barcelona, 1998.

- FRANCISCO MUÑOZ GRACIA. "Cálculo teórico-práctico de los elementos y grupos del vehículo industrial y automóvil I". Editorial Dossat. España.
- FRANCISCO MUÑOZ GRACIA. "Cálculo teórico-práctico de los elementos y grupos del vehículo industrial y automóvil II". Editorial Dossat. España.

- LAFONT, P., DÍAZ, A. eta ECHAVARRI, J. "Diseño y cálculo de transmisiones por engranajes". Universidad Politécnica de Madrid. Madrid, 2009.

- MIKEL ABASOLO BILBAO, SANTIAGO NAVALPOTRO CUENCA, EDURNE IRIONDO PLAZA. "Diseño de máquinas". Euiti Bilbao; Universidad del País Vasco.

- MUÑOZ, F. "Cálculo teórico-práctico de los elementos y grupos del vehículo industrial y automóvil". Editorial Litoprint. Madrid, 1991.

- NORTON, R. L. "Diseño de máquinas". Editorial Pearson. Madrid, 2011.

- SANTOS, J.A. eta PEREZ, A. "Ingeniaritza proiektuak". Bilboko IITUE. Bilbo, 2008.

CATALOGUE

- SKF
- BENERT
- OPAC
- TRASMIL
- CLUTCH CATALOGUE (NATIONAL AUTO)

WEBSITES

- www.skf.com
- www.arpem.com
- www.8000vueltas.com
- www.national-auto.co.uk
- www.ro-des.com
- www.autonocion.com
- www.previa.uclm.es
- www.trasmil.it
- www.aficionadosalamecanica.com
- www.mecanicavirtual.com.ar
- www.aenor.es
- www.autocasion.com