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OPTIMIZATION OF CYCLOIDAL GEAR REDUCER BY INSTANTANEOUS CENTRE METHOD (ICR)

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Abstract: The word Cycloid, with its adjective Cycloidal, is derived from Hypocycloid which describes the curve traced by a point on the circumference of a smaller circle rotating inside the circumference of a larger fixed circle. Just like words such as helical, worm, spur, and bevel, cycloidal is a generic adjective; it merely describes the gearing mechanism inside the speed reducer.

A cycloid speed reducer is one of the rotational speed regulation devices of the machinery. It has advantages of the higher reduction ratio, the higher accuracy, the easier adjustment of the transmission ratio, high shock load absorption capacity and the smaller workspace than any other kinds of the reducer. This paper proposes a simple and exact approach for the lobe profile design of the cycloid plate gear, which is a main part of the cycloid reducer.

Keywords: Cycloidal Gear Reducer, Gear Material, V-Belt Drive.

INTRODUCTION:

Speed reducers are used widely in various applications for speed and torque conversion purposes. Among them, a cycloid reducer has been used for decades owing to their smooth and high performance, high reliability, long service life, compactness, exceptional overload capacity, low to zero backlash through rolling tooth engagement in the contact mechanism, and other advantages. Therefore it makes an attractive candidate for limited space applications today.

A cycloid plate gear, which is a main part of the cycloid reducer, meshes in all teeth or lobes at any one time with the roller gear (or ring gear) consisted of several rollers on the circular pitch line. Generally, it is classified into four types of the cycloid drives by the lobe profile of the cycloid plate gear and the roller gear motion; the stationary ring gear type epicycloid reducer, the rotating ring gear type epicycloid reducer, the stationary ring gear type hypocycloid reducer and the rotating ring gear type hypocycloid reducer.

LITERATURE REVIEW

Review on cycloidal gear reducer

Joong-ho shin et.al [4] had proposed in their paper a simple expert approach further lobe profile design of the cycloid plate gear which is the main part of cycloid reducer by means of a principle of the instant velocity center in their general contact mechanism & the homogeneous coordinate transformation. It explain the profile outline of the cycloidal planetary gear lobes. Nachimowicz Jerzy[20] has presented the process of modelling a cycloidal gear designing the profile of the cycloidal gear is complex, hence it is necessary to use the suitable spreadsheets, for ex. Microsoft excel software or other computer aided engineering program like Mathcad, statistica or other 2D plots generators. Wan –Sung Lin [11] has presented the new design of a two stage cycloidal speed reducer. Two new structures of two stage cycloidal speed reducer are then enumerated after topological analysis. Is has been shown that a smaller quantity of modification may yield smaller kinematic error. Based on this result obtained new cycloidal drive is realizable as a compact, high speed reduction device.

Kumar Naren et.al [21] has presented a novel method comprising both analytical and numerical technique for the effective determination of the elastic torsional compliance of single stage cycloidal drive based on static experimental results conducted on a commercially available gear drive. G. Meneghatti et.al [22] in his paper a twin disc test rig is presented, that was convenient to reproduce the contact pressure & sliding velocity of gear at one particular point along the tooth profile. Malhotra. S.K [1] has presented in this paper, a procedure to calculate the forces on various elements of the speed reducer as well as the theoretical efficiency is presented. Also the effect of design parameters on forces and contact stress are studied which will aid optimal design of this

type of speed reducer

Giorgio figoliolini et.al [10] has presented in this paper the concept of rendering of the tooth profile of gear with skew axis. Paper has also proposed that it should lead to optimum plank in sense of minimizing the power caused by coulomb friction upon sliding which is unavoidable in gears with skew axis.

A Review on Design Consideration

Thube V. et.al [8] has discussed a 3D finite element method for load distribution & dynamic contact analysis of low reduction ratio cycloidal reducer using commercially Algor FEA code. This study gives an insight of internal load sharing of rotating parts & their capability of carrying loads. Yii-Wen Hwang [5] has designed the profile of inner rotor by equidistance to an opitrochoidal curve. The mathematical model in parametric form and simpler dimensionless equation of non-undercutting are derived. The paper also suggest a better design for improving the carryover phenomenon of gerotor pump. Ren Zong-Yi et.al [25] has presented in there paper a new method of cycloid disc tooth modification is presented in this paper. A multi-DOF non-linear dynamic model of cycloidal speed reducer is established, the cycloid disc rotation velocity vs time of different modification clearance are solved by the Runge-kutta numerical method. Chiu-fan Hsieh [15] has presented in this paper the concept of tooth difference with reference to the traditional and improved designs. Paper has proposed non pin design with multi tooth difference. When the transmission ratio is low, two teeth difference is commonly used and the traditional method suggests the use of one tooth difference.

A Review on Motor & Drive

Feki N. et.al [9] paper deals with the simulation of the dynamic behavior of the dynamic behavior of induction/gear system. Based on no of simulation, it is shown that the frequencies associated with defect can be identified and that using stator current seems promising alternatives to the classic based on mechanical vibration analysis. Stanislaw gramblicka et.al [23] has presented in this paper the behavior of electric drive torque for motor. The paper has proposed the concept that electric drive torque must overcome inertia of rotating masses at starting of motor to achieve stable operations at steady state. Shouhei shirafuji et.al has presented in this paper that the frictional force and the tensile force are dependent on the properties of material of belt and pulley. Paper has also proposed by varying the contact angle and coefficient of friction sufficiently large enough friction force could be done to resist large applied tensile force

Xinmin LI et.al [18] has presented the simulation of the sliding part of the gear tooth contact in boundary and mixed lubricated region, comparing the trobological characteristics of two sintered gear materials with those of a standard gear material by using pin-on-disc machine. The friction and wear coefficient in high speed test are consistently lower than in the low speed tests.

CONCLUSION:

With the help of instant velocity Centre method is very useful to optimize the size and the weight of cycloidal gear which in turns to minimize the annual cost of production. The size of Cycloidal gear reducer is decreased by minimizing number of links and material.

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