International Journal of Psychosocial Rehabilitation, Vol. 23, Issue 03, 2019
ISSN: 1475-7192

Design and Fabrication of Balancing Gyroscope

N. Lenin Rakesh, R. Srinath, P. Shankar Kannan and
R.L. Hari Govindhan

Abstract--- *Whenever a rotating body experiences a force on its axis of rotation, a couple is formed on the rotating body. This couple is known as gyroscopic couple and it nullify the force to a certain extent which is proportional to the mass, speed of rotation and radius of gyration. When the applied force exceeds the moment of inertia of the gyroscope then the disc exhibits precession in a plane perpendicular to the plane of force and plane of rotation. In other words, gyroscopic effect arises whenever the axis of rotating body is caused to change direction In this project our objective is to utilize this gyroscopic effect caused by the change in axis of rotation to balance an apparatus in the basic form of a bicycle or bike. This is done by using weighted disc(s) controlled by gyroscopic sensor by changing its axis of rotation and speed of rotation.*

Keywords--- *Balancing Gyroscope, Speed of Rotation, Gyroscopic, External Torque.*

I. INTRODUCTION

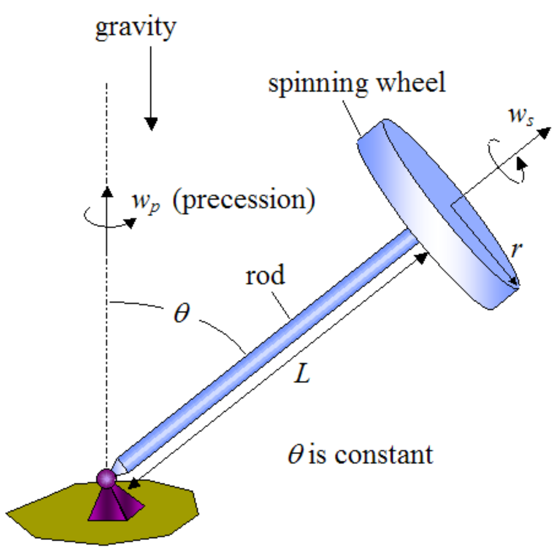

Fig. 1: Law Of Gyroscopic

A **gyroscope** is a device for measuring or maintaining orientation, based on the principles of angular momentum. Mechanically, a gyroscope is a spinning wheel or disc in which the axle is free to assume any orientation. Although this orientation does not remain fixed, it changes in response to an external torque much less

N. Lenin Rakesh, Assistant Professor, Department of Mechanical Engineering, BIST, BIHER, Bharath Institute of Higher Education & Research, Selaiyur, Chennai.
R. Srinath, UG Scholar, Department of Mechanical Engineering, BIST, BIHER, Bharath Institute of Higher Education & Research, Selaiyur, Chennai.
P. Shankar Kannan, UG Scholar, Department of Mechanical Engineering, BIST, BIHER, Bharath Institute of Higher Education & Research, Selaiyur, Chennai.
R.L. Hari Govindhan, UG Scholar, Department of Mechanical Engineering, BIST, BIHER, Bharath Institute of Higher Education & Research, Selaiyur, Chennai.

Received: 20 Feb 2019 | Revised: 09 Mar 2019 | Accepted: 02 Apr 2019

and in a different direction than it would with the large angular momentum associated with the disc's high rate offspin and moment of inertia. The device's orientation remains nearly fixed, regardless of the mounting platform's motion, because mounting the device in a gimbal minimizes external torque.

Gyroscopes based on other operating principles also exist, such as the electronic, microchip-packaged MEMS gyroscope devices found in consumer electronic devices, solid-state ring lasers, fibre optic gyroscopes, and the extremely sensitive quantum gyroscope.

Applications of gyroscopes include inertial navigation systems where magnetic compasses would not work (as in the Hubble telescope) or would not be precise enough (as in ICBMs), or for the stabilization of flying vehicles like radio-controlled helicopters or unmanned aerial vehicles. Due to their precision, gyroscopes are also used in gyrotheodolites to maintain direction in tunnel mining.

The above shown figure illustrates the gyroscopic balancing system setup showing flow of information or data.

The objective of our project is to use the gyroscopic effect produced by a classic spinning gyroscope to balance the prototype bike frame using the gyroscopic couple to stabilize and gyroscopic moment caused in a gimbal to recover the balance.

II. DESIGN OF GYROSCOPE

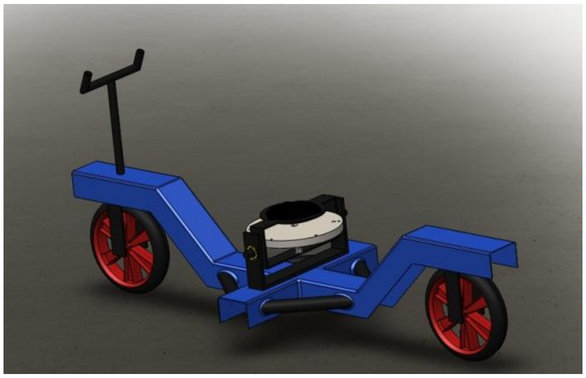

Fig. 2: Design of Gyroscopic

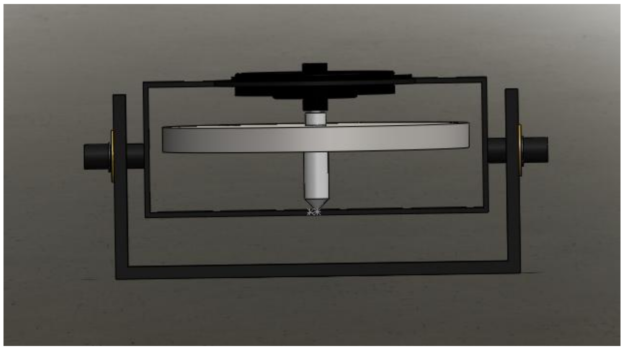

Fig. 3: Disc In Gyroscopic

III. TURNING AND FACING

Turning is a machining process in which a cutting tool, typically a non-rotary tool bit, describes a helical toolpath by moving more or less linearly while the workpiece rotates. The tool's axes of movement may be literally a straight line, or they may be along some set of curves or angles, but they are essentially linear (in the nonmathematical sense). Usually the term "turning" is reserved for the generation of external surfaces by this cutting action, whereas this same essential cutting action when applied to internal surfaces (that is, holes, of one kind or another) is called "boring". Thus the phrase "turning and boring" categorizes the larger family of (essentially similar) processes. The cutting of faces on the workpiece (that is, surfaces perpendicular to its rotating axis), whether with a turning or boring tool, is called "facing", and may be lumped into either category as a subset.

Fig. 4: Fabrication

Turning can be done manually, in a traditional form of lathe, which frequently requires continuous supervision by the operator, or by using an automated lathe which does not. Today the most common type of such automation is computer numerical control, better known as CNC. (CNC is also commonly used with many other types of machining besides turning.) When turning, a piece of relatively rigid material (such as wood, metal, plastic, or stone) is rotated and a cutting tool is traversed along 1, 2, or 3 axes of motion to produce precise diameters and depths. Turning can be either on the outside of the cylinder or on the inside (also known as boring) to produce tubular components to various geometries. Although now quite rare, early lathes could even be used to produce complex geometric figures, even theplatonic solids; although since the advent of CNC it has become unusual to use non-computerized toolpath control for this purpose.

The turning processes are typically carried out on a lathe, considered to be the oldest machine tools, and can be of four different types such as straight turning, taper turning, profiling or external grooving. Those types of turning processes can produce various shapes of materials such as straight, conical,curved, or grooved workpiece. In general, turning uses simple single-point cutting tools. Each group of workpiece materials has an optimum set of tools angles which have been developed through the years.

The bits of waste metal from turning operations are known as chips (North America), or swarf (Britain). In some areas they may be known as turnings

IV. DRILLING

Drilling is a cutting process that uses a drill bit to cut or enlarge a hole of circular cross-section in solid materials. The drill bit is a rotary cutting tool, often multipoint. The bit is pressed against the workpiece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the workpiece, cutting off chips (swarf) from the hole as it is drilled.

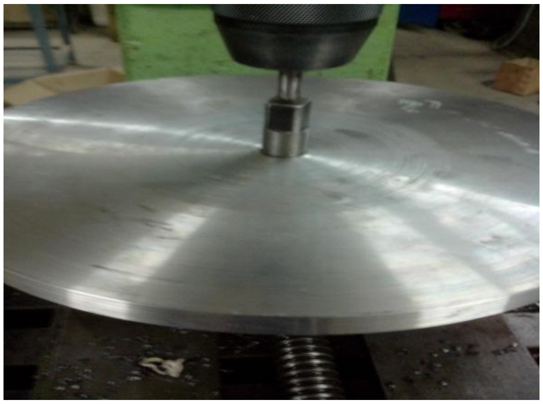

Fig. 5: Drilling

Fig 6: Fabrication Of Parts

This is important because in manual welding, it can be difficult to hold the electrode perfectly steady, and as a result, the arc length and thus voltage tend to fluctuate. Constant voltage power supplies hold the voltage constant and vary the current, and as a result, are most often used for automated welding processes such as gas metal arc welding, flux cored arc welding, and submerged arc welding. In these processes, arc length is kept constant, since any fluctuation in the distance between the wire and the base material is quickly rectified by a large change in current. For example, if the wire and the base material get too close, the current will rapidly increase, which in turn causes the heat to increase and the tip of the wire to melt, returning it to its original separation distance.

The direction of current used in arc welding also plays an important role in welding. Consumable electrode processes such as shielded metal arc welding and gas metal arc welding generally use direct current, but the electrode can be charged either positively or negatively. In welding, the positively charged anode will have a greater heat concentration and, as a result, changing the polarity of the electrode has an impact on weld properties. If the electrode is positively charged, it will melt more quickly, increasing weld penetration and welding speed.

Alternatively, a negatively charged electrode results in more shallow welds.[2] Non-consumable electrode processes, such as gas tungsten arc welding, can use either type of direct current (DC), as well as alternating current (AC). With direct current however, because the electrode only creates the arc and does not provide filler material, a positively charged electrode causes shallow welds, while a negatively charged electrode makes deeper welds.Alternating current rapidly moves between these two, resulting in medium-penetration welds. One disadvantage of AC, the fact that the arc must be re-ignited after every zero crossing, has been addressed with the invention of special power units that produce a square wave pattern instead of the normal sine wave, eliminating low-voltage time after the zero crossings and minimizing the effects of the problem.

Duty cycle is a welding equipment specification which defines the number of minutes, within a 10 minute period, during which a given arc welder can safely be used. For example, an 80 A welder with a 60% duty cycle must be "rested" for at least 4 minutes after 6 minutes of continuous welding. Failure to observe duty ecycle limitations could damage the welder. Commercial- or professional-grade welders typically have a 100% duty cycle.

Fig 7: Painted Part

Fig 8: Finished Model

V. CONCLUSION

- Thus the balancing of self-balancing gyroscopic couple was achieved
- As the frame weight increases the balancing of gyroscopic setup needed more moment for stabilization
- As the centre of gravity of the gyroscopic disc mounted on pivot lowers, the speed of precision along with the moment lowers.
- When the gyroscope is placed anywhere other than the centre of gravity of the frame, then the net moment generated by the apparatus decreases gradually. Hence resulting in unbalancing of the bike frame.
- When the length of the bike frame increases, the total twisting moment of the frame is to be considered as a retardation factor in the gyroscopic moment. Thus obstructing the stabilization of apparatus.

REFERENCES

[1] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2014). Virtual instrumentation based process of agriculture by automation. *Middle-East Journal of Scientific Research*, *20*(12): 2604-2612.

[2] Udayakumar, R., Kaliyamurthie, K.P., & Khanaa, T.K. (2014). Data mining a boon: Predictive system for university topper women in academia. *World Applied Sciences Journal*, *29*(14): 86-90.

[3] Anbuselvi, S., Rebecca, L.J., Kumar, M.S., & Senthilvelan, T. (2012). GC-MS study of phytochemicals in black gram using two different organic manures. *J Chem Pharm Res*., *4*, 1246-1250.

[4] Subramanian, A.P., Jaganathan, S.K., Manikandan, A., Pandiaraj, K.N., Gomathi, N., & Supriyanto, E. (2016). Recent trends in nano-based drug delivery systems for efficient delivery of phytochemicals in chemotherapy. *RSC Advances*, *6*(54), 48294-48314.

[5] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2014). Partial encryption and partial inference control based disclosure in effective cost cloud. *Middle-East Journal of Scientific Research*, 20(12), 2456-2459.

[6] Lingeswaran, K., Prasad Karamcheti, S.S., Gopikrishnan, M., & Ramu, G. (2014). Preparation and characterization of chemical bath deposited cds thin film for solar cell. *Middle-East Journal of Scientific Research*, *20*(7), 812-814.

[7] Maruthamani, D., Vadivel, S., Kumaravel, M., Saravanakumar, B., Paul, B., Dhar, S.S., Manikandan, A., & Ramadoss, G. (2017). Fine cutting edge shaped Bi2O3rods/reduced graphene oxide (RGO) composite for supercapacitor and visible-light photocatalytic applications. *Journal of colloid and interface science*, *498*, 449-459.

[8] Gopalakrishnan, K., Sundeep Aanand, J., & Udayakumar, R. (2014). Electrical properties of doped azopolyester. *Middle-East Journal of Scientific Research*, *20*(11). 1402-1412.

[9] Subhashree, A.R., Parameaswari, P.J., Shanthi, B., Revathy, C., & Parijatham, B.O. (2012). The reference intervals for the haematological parameters in healthy adult population of chennai, southern India. *Journal of Clinical and Diagnostic Research: JCDR*, *6*(10), 1675-1680.

[10] Niranjan, U., Subramanyam, R.B.V., & Khanaa, V. (2010, September). Developing a web recommendation system based on closed sequential patterns. In *International Conference on Advances in Information and Communication Technologies*, *101*, 171-179. Springer, Berlin, Heidelberg.

[11] Slimani, Y., Baykal, A., & Manikandan, A. (2018). Effect of Cr3+ substitution on AC susceptibility of Ba hexaferrite nanoparticles. *Journal of Magnetism and Magnetic Materials*, *458*, 204-212.

[12] Premkumar, S., Ramu, G., Gunasekaran, S., & Baskar, D. (2014). Solar industrial process heating associated with thermal energy storage for feed water heating. *Middle East Journal of Scientific Research*, *20*(11), 1686-1688.

[13] Kumar, S.S., Karrunakaran, C.M., Rao, M.R.K., & Balasubramanian, M.P. (2011). Inhibitory effects of Indigofera aspalathoides on 20-methylcholanthrene-induced chemical carcinogenesis in rats. *Journal of carcinogenesis*, *10*.

[14] Beula Devamalar, P.M., Thulasi Bai, V., & Srivatsa, S.K. (2009). Design and architecture of real time web-centric tele health diabetes diagnosis expert system. *International Journal of Medical Engineering and Informatics*, *1*(3), 307-317.

Received: 20 Feb 2019 | Revised: 09 Mar 2019 | Accepted: 02 Apr 2019

[15] Ravichandran, A.T., Srinivas, J., Karthick, R., Manikandan, A., & Baykal, A. (2018). Facile combustion synthesis, structural, morphological, optical and antibacterial studies of Bi1− xAlxFeO3 (0.0≤ x≤ 0.15) nanoparticles. *Ceramics International*, *44*(11), 13247-13252.

[16] Thovhogi, N., Park, E., Manikandan, E., Maaza, M., & Gurib-Fakim, A. (2016). Physical properties of CdO nanoparticles synthesized by green chemistry via Hibiscus Sabdariffa flower extract. *Journal of Alloys and Compounds*, *655*, 314-320.

[17] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2014). Wide area wireless networks-IETF. *Middle-East Journal of Scientific Research*, *20*(12), 2042-2046.

[18] Sundar Raj, M., Saravanan, T., & Srinivasan, V. (2014). Design of silicon-carbide based cascaded multilevel inverter. *Middle-East Journal of Scientific Research*, *20*(12), 1785- 1791.

[19] Achudhan, M., Jayakumar M.P. (2014). Mathematical modeling and control of an electrically-heated catalyst. *International Journal of Applied Engineering Research, 9*(23), 23013.

[20] Thooyamani, K.P., Khanaa, V., & Udayakumar, R. (2013). Application of pattern recognition for farsi license plate recognition. *Middle-East Journal of Scientific Research*, *18*(12), 1768-1774.

[21] Jebaraj, S., Iniyan S. (2006). Renewable energy programmes in India. *International Journal of Global Energy Issues, 26*(43528), 232-257.

[22] Sharmila, S., & Jeyanthi Rebecca, L. (2013). Md Saduzzaman., Biodegradation of domestic effluent using different solvent extracts of Murraya koenigii. *J Chem and Pharm Res*, *5*(2), 279-282.

[23] Asiri, S., Sertkol, M., Guner, S., Gungunes, H., Batoo, K.M., Saleh, T.A., Manikandan A., & Baykal, A. (2018). Hydrothermal synthesis of CoyZnyMn1-2yFe2O4 nanoferrites: magneto-optical investigation. *Ceramics International*, *44*(5), 5751-5759.

[24] Rani, A.J., & Mythili, S.V. (2014). Study on total antioxidant status in relation to oxidative stress in type 2 diabetes mellitus. *Journal of clinical and diagnostic research: JCDR*, *8*(3), 108-110.

[25] Karthik, B. (2014). Arulselvi, Noise removal using mixtures of projected gaussian scale mixtures. *Middle-East Journal of Scientific Research*, *20*(12), 2335-2340.

[26] Karthik, B., Arulselvi, & Selvaraj, A. (2014). Test data compression architecture for low power VLSI testing. *Middle - East Journal of Scientific Research*, *20*(12), 2331-2334.

[27] Vijayaragavan, S.P., Karthik, B., & Kiran Kumar, T.V.U. (2014). Privacy conscious screening framework for frequently moving objects. *Middle-East Journal of Scientific Research*, *20*(8), 1000-1005.

[28] Kaliyamurthie, K.P., Parameswari, D., & Udayakumar, R. (2013). QOS aware privacy preserving location monitoring in wireless sensor network. *Indian Journal of Science and Technology*, *6*(5), 4648-4652.

[29] Silambarasu, A., Manikandan, A., & Balakrishnan, K. (2017). Room-temperature superparamagnetism and enhanced photocatalytic activity of magnetically reusable spinel ZnFe 2 O 4 nanocatalysts. *Journal of Superconductivity and Novel Magnetism*, *30*(9), 2631-2640.

[30] Jasmin, M., Vigneshwaran, T., & Beulah Hemalatha, S. (2015). Design of power aware on chip embedded memory based FSM encoding in FPGA. *International Journal of Applied Engineering Research*, *10*(2), 4487-4496.

[31] Philomina, S., & Karthik, B. (2014). Wi-Fi energy meter implementation using embedded linux in ARM 9. *Middle-East Journal of Scientific Research*, *20*, 2434-2438.

[32] Vijayaragavan, S.P., Karthik, B., & Kiran Kumar, T.V.U. (2014). A DFIG based wind generation system with unbalanced stator and grid condition. *Middle-East Journal of Scientific Research*, *20*(8), 913-917.

[33] Rajakumari, S.B., & Nalini, C. (2014). An efficient data mining dataset preparation using aggregation in relational database. *Indian Journal of Science and Technology*, *7*, 44-46.

[34] Karthik, B., Kiran Kumar, T.V.U., Vijayaragavan, P., & Bharath Kumaran, E. (2013). Design of a digital PLL using 0.35 Î¼m CMOS technology. *Middle-East Journal of Scientific Research*, *18*(12), 1803-1806.

[35] Sudhakara, P., Jagadeesh, D., Wang, Y., Prasad, C.V., Devi, A.K., Balakrishnan, G., Kim B.S., & Song, J.I. (2013). Fabrication of Borassus fruit lignocellulose fiber/PP composites and comparison with jute, sisal and coir fibers. *Carbohydrate polymers*, *98*(1), 1002-1010.

[36] Kanniga, E., & Sundararajan, M. (2011). Modelling and characterization of DCO using pass transistors. In *Future Intelligent Information Systems,* 86(1), 451-457. Springer, Berlin, Heidelberg.

[37] Sachithanandam, P., Meikandaan, T.P., & Srividya, T. Steel framed multi storey residential building analysis and design. *International Journal of Applied Engineering Research*, *9*(22), 5527-5529.

[38] Kaliyamurthie, K.P., Udayakumar, R., Parameswari, D., & Mugunthan, S.N. (2013). Highly secured online voting system over network. *Indian Journal of Science and Technology*, *6*(S6), 4831-4836.

[39] Sathyaseelan, B., Manikandan, E., Lakshmanan, V., Baskaran, I., Sivakumar, K., Ladchumananandasivam, R., Kennedy, J., & Maaza, M. (2016). Structural, optical and morphological properties of post-growth calcined TiO2 nanopowder for opto-electronic device application: Ex-situ studies. *Journal of Alloys and Compounds*, *671*, 486-492.

[40] Saravanan, T., Sundar Raj M., & Gopalakrishnan K. (2014). SMES technology, SMES and facts system, applications, advantages and technical limitations. *Middle - East Journal of Scientific Research*, *20*(11), 1353-1358.

[41] Mangala Nachar, M., & Vinitha Subashini, B. (2015). A Comparative Study of Web Data Extraction and Alignment Tools, *International Journal of Advances in Engineering and Emerging Technology, 7*(3), 73-83.

[42] Shandiya, G., Sindhu, G., Suganya, M., & Vasuki, J. (2015). Detecting and Preventing Cruel Url Using Linkguard Algorithm. *International Journal of Advances in Engineering and Emerging Technology, 7*(3), 139-151.

[43] Zahirajahan, N., and SureshKumar, N. (2014). 4G Technology. *Excel International Journal of Technology, Engineering and Management, 1*(2), 58-61.

[44] Saranaya, M., and Gowrishankar, R. (2014). Brain Computer Interface. *Excel International Journal of Technology, Engineering and Management, 1*(2), 62-67.

[45] Muthuram, R., & Dr.Kousalya, G. (2017). SDS: A Framework for Secure Data Sharing in Database as a Service. *Bonfring International Journal of Data Mining*, *7*(1), 01-08.

[46] Mofradi, R.F., & Nasab, M.S. (2017). Using of the Vernier frequencies method to resolve problem of the ambiguity in range of the pulsed radars. *International Academic Journal of Innovative Research*, *4*(3), 10-21.

[47] Kalaiyarasi, V., & Dr.Tamilarasi. M.(2015). Survey of Load Balancing Routing in MANET. *International Journal of Communication and Computer Technologies, 3*(2), 58-62.

[48] Yamine, R.T., & Nithya, N.S. (2015). Survey on High Utility Itemset Mining. *International Journal of Communication and Computer Technologies, 3*(2), 63-66.

[49] Hayden, & Beau. (2017). Top-N Firewall Approximation Algorithm in Virtual Private Networks for Preserving the Dependency Relationships. *Bonfring International Journal of Industrial Engineering and Management Science*, *7*(2), 26-31.

[50] Ofoghi, R. (2015). Technical and structural analysis of the wireless networks, safety and security analysis of wireless and cable networks. *International Academic Journal of Science and Engineering, 2*(5), 39-44.