ANALYSIS OF STEERING SYSTEM IN VEHICLES

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Abstract

Herein, a steering system with rack and pinion arrangement that are ordinarily utilized because of their straightforwardness in development and minimization. The primary motivation behind this paper is to recieve the design and manufacturing of manual rack and manual pinion guiding system as per the prerequisite of the vehicle for better mobility. Amounts like turning circle sweep, steering ratio, steering effort, and so forth are between subject to one another and in this manner there are distinctive structure thought by the sort of vehicle. The examination of result is indicated utilizing tables which will structure an effective steering for the vehicle [1], [2].

Keywords: steering, vehicle, automobile, rack and pinion, steering effort, steering ratio, motion transmission

Introduction

Steering is the term applied to the collection of components, linkages, etc. which will allow a vessel (ship or Boat) or vehicle to follow the desired course. An exception is the case of rail transport by which rail tracks combined together with railroad switches provide steering column, which may contain universal joints, to allow it to deviate somewhat from a straight line [3], [4]. The most conventional steering arrangement is to turn the front wheels using a hand–operated steering wheel which is positioned in front of the driver. The steering system acts a significant role of making car convenient to handle and enhance the vehicle stability. In the past one hundred years, the development of steering system has experienced many stages, and the Steer-by-Wire system (SBW) is the newest technology of steering system for passenger cars. But the Steer-by-Wire system has not yet accepted by public consumers and permitted by state regulations, in consideration of the reliability and safety of the system. The steering system of a vehicle allows the driver to control the direction of the vehicle through a system of gears and linkages that connects the steering wheel with the front wheels. In conventional steering system , the Ackermann geometry this is the arrangement of linkages in the steering of a car or other vehicle designed to solve the problem of wheel on the inside and outside of a turn needing to trace out circles of different radii [5]. In Anti-Ackermann geometry at low steering ratio and at high speed, handling capacity is low to eliminate this drawback , the Ackermann geometry is used. In Ackermann geometry high speed handling increases and reduces the condition of over-steer and the vehicle handling capacity increases. The materials used in the steering system target precise operation and light weight components. Although precision and weight are the top priorities, cost, manufacturability, and reliability were also considered. Precision in the steering system is derived from high manufacturing tolerances and minimal deflection.

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Deflection in any component leads to steer compliance, resulting in an unresponsive steering system. A gear tooth profile was selected based on BIS (Bureau of Indian Standard) recommendation and the manufacturability. A 200 full depth involute profile system was selected [6], [7].

Conclusion

To improve the steering geometry i.e. Ackerman geometry, which helps the driver to avoid the negative effect of cornering forces acting on the vehicle & increases the space in cockpit area and the comfort of driver. Steering geometry can be optimized by using mathematical model for Ackerman condition for different inner wheel angles and select geometry for which percentage Ackermann as well steering effort is optimum. The composite material increases the strength of rack & pinion & reduces the weight of system which helps to reduce gross weight of vehicle. The weight Composite Material is reduced as compared to others material which is turn result in improved power transmission which overall improve the efficiency of the system.

References

[1] C. Hu *et al.*, "Lane keeping of autonomous vehicles based on differential steering with adaptive multivariable super-twisting control," *Mech. Syst. Signal Process.*, vol. 125, pp. 330–346, Jun. 2019.

[2] G. Gatti, M. J. Brennan, and B. Tang, "Some diverse examples of exploiting the beneficial effects of geometric stiffness nonlinearity," *Mech. Syst. Signal Process.*, vol. 125, pp. 4–20, Jun. 2019.

[3] Y. Ma, J. Chen, X. Zhu, and Y. Xu, "Lateral stability integrated with energy efficiency control for electric vehicles," *Mech. Syst. Signal Process.*, vol. 127, pp. 1–15, Jul. 2019.

[4] X. Ma, P. K. Wong, and J. Zhao, "Practical multi-objective control for automotive semi-active suspension system with nonlinear hydraulic adjustable damper," *Mech. Syst. Signal Process.*, vol. 117, pp. 667–688, Feb. 2019.

[5] M. Völker and W. Stadie, "Electrohydraulic rear axle steering systems for agricultural vehicles," *Atzoffhighw. Worldw.*, vol. 10, no. 4, pp. 22–27, Nov. 2017.

[6] C. Hu, R. Wang, F. Yan, Y. Huang, H. Wang, and C. Wei, "Differential Steering Based Yaw Stabilization Using ISMC for Independently Actuated Electric Vehicles," *IEEE Trans. Intell. Transp. Syst.*, vol. 19, no. 2, pp. 627–638, Feb. 2018.

[7] C. Zhang, J. Hu, J. Qiu, W. Yang, H. Sun, and Q. Chen, "A Novel Fuzzy Observer-Based Steering Control Approach for Path Tracking in Autonomous Vehicles," *IEEE Trans. Fuzzy Syst.*, vol. 27, no. 2, pp. 278–290, Feb. 2019.