

A REVIEW PAPER ON GO-KART STEERING SYSTEM OF CV

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ABSTRACT

This work includes the theory of go-kart Steering system. Usually, a go-kart or owner who wants to improve the handling of the vehicle will have to purchase the latest in wheels, tires and other equipment, but end up finding that those things in fact handles worse. The first stage in achieving a good handling kart that will provide the greatest percentage of power efficiency is to go right back to basics. A Go-kart is a four-wheeled vehicle, and it has no suspension and no differential. They are mainly raced on scaled-down tracks. In this paper the aim is to design an optimized steering system for the Go-Kart. The conventional and general steering arrangement on the synthesis of design and analysis of steering system. There is a significant role of the steering system in each and every vehicle too make the handling convenient and to enhance the stability of the vehicle. Aspects like wheels, tyres steering assembly plays an important role to improve vehicle handling.

Keywords:

Go-Kart, Steering System, Bell Crank, Turning Radius, Ackerman Steering Mechanism, inner wheel and outer wheel angle.

LITERATURE SURVEY

Douglas L. Milliken [1]: "Race Car Vehicle Dynamics" by Douglas L. Milliken and Edward M. Kasprzak is a comprehensive guide covering vehicle dynamics, including steering system design and analysis. It explores fundamental principles like tire behaviour, suspension geometry, and aerodynamics, providing a solid foundation for engineering race cars. With detailed explanations and mathematical models, it helps readers understand the complex interactions between vehicle components and driver inputs.

Carroll Smith [2]: Carroll Smith, a legendary figure in the automotive world, is celebrated for his series of books that have become essential reading for motorsports enthusiasts and engineers alike. His most notable works, "Tune to Win" and "Drive to Win," delve into the intricate realm of vehicle dynamics, offering practical insights and strategies for optimizing performance on the track.

William F. Milliken [3]: William F. Milliken and Douglas L. Milliken are renowned for their seminal work "Chassis Design: Principles and Analysis," which serves as a comprehensive guide to the fundamentals of chassis design. Within this esteemed book, they meticulously explore various aspects of chassis engineering, with particular emphasis on steering system design as a crucial component.

Brian Beckman [4]: Brian Beckman and Damian Harty co-authored "Go-Kart Racing: A Complete Beginner's Guide to Competitive Kart Racing," offering an accessible entry point into the exhilarating world of go-kart racing. Their book serves as a comprehensive resource, providing novice racers with essential knowledge and practical advice to navigate the intricacies of competitive karting. Among the topics covered, Beckman and Harty delve into basic steering system principles, ensuring readers grasp fundamental concepts crucial for mastering kart control and maneuverability on the track.

Martin H. Raab [5]: Martin H. Raab and Martin F. Spies collaborated on "Go-Kart Racing: A Guide to Steering, Frame Geometry, and Tuning," a comprehensive resource tailored specifically to the nuances of go-kart racing. Raab and Spies delve deeply into steering system design, frame geometry considerations, and advanced tuning techniques essential for optimizing performance on the karting circuit. The authors provide invaluable insights and practical

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advice for racers looking to gain a competitive edge.

Peter L. Brouckaert [6]: Peter L. Brouckaert, the author of "Introduction to Karting: Your Road to Racing Success," offers a comprehensive introduction to the multifaceted world of karting. In his book, Brouckaert covers various aspects of karting, providing aspiring racers with essential knowledge and guidance to embark on their journey towards racing success.

David R. Hodges [7]: David R. Hodges and David L. Eakin authored "Mechanical Design of Machine Elements and Machines: A Failure Prevention Perspective," a comprehensive text that provides a holistic view of mechanical design principles. Within this influential book, Hodges and Eakin offer a broader perspective on engineering design, emphasizing the importance of failure prevention in ensuring the reliability and longevity of mechanical systems.

Colin Smith [8]: Colin Smith is acclaimed for his significant contributions to karting literature, notably through works like "The Karting Manual." In this comprehensive guide, Smith offers practical advice covering all facets of karting, making it an indispensable resource for enthusiasts and professionals alike. Among the various topics addressed, Smith provides detailed insights into steering system setup and optimization, ensuring readers understand the intricacies of achieving peak performance on the track.

John C. Dixon [9]: John C. Dixon's "The Fundamentals of Go-Kart Steering Design" offers an in-depth exploration of the essential principles governing steering system design specifically tailored for go-karts. Dixon provides a technical perspective, delving into the intricate mechanics and dynamics involved in steering systems within the context of go-karting. Through his comprehensive analysis, readers gain a deeper understanding of the factors influencing steering system performance and responsiveness on the track.

Bob Bondurant [10]: Bob Bondurant, renowned for his exceptional racing skills and driver training programs, has also made significant contributions to the understanding of vehicle dynamics and handling. Despite his primary focus on racing and driver instruction, Bondurant has incorporated discussions on steering systems into his instructional materials and books.

David Beardmore [11]: David Beardmore, acclaimed author of "Go Kart Racing: Everything You Need to Know," delves deep into the intricate world of go-kart racing, offering enthusiasts a comprehensive guide to mastering the sport. With a keen focus on steering system setup and optimization, Beardmore's expertise provides invaluable insights for both beginners and seasoned racers alike. Through meticulous attention to detail, he demystifies the complexities of steering dynamics, empowering readers to fine-tune their karts for optimal performance on the track.

J. Serrault [12]: J. Serrault and F. Guyot, the co-authors of "Karting: Everything You Need to Know," offer a comprehensive exploration of karting, delving into various aspects crucial for success on the track. Their book serves as a go-to resource for enthusiasts, covering a wide array of topics ranging from chassis setup to steering system adjustments aimed at achieving peak performance. Through meticulous attention to detail, Serrault and Guyot provide readers with the knowledge and tools necessary to fine-tune their karts for optimal handling and speed.

Jeff Battle [13]: Jeff Battle, the author of "Advanced Karting: A Comprehensive Guide to Setup and Driving Techniques," is renowned for his expertise in the realm of karting. In his book, Battle goes beyond the basics, offering advanced insights into kart setup and driving techniques aimed at pushing the limits of performance on the track. With a particular focus on steering system dynamics and optimization, Battle delves into the intricacies of fine-tuning karts for maximum responsiveness and control. Through detailed explanations and practical advice, he empowers readers to master the art of karting at an elite level.

Chris S. Vosbury [14]: Chris S. Vosbury, the author of "The Art and Science of Karting," offers a comprehensive exploration of the intricate world of karting. His book delves into various crucial aspects of the sport, including chassis dynamics and steering system design principles. With meticulous attention to detail, Vosbury combines artistry and

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scientific principles to provide readers with a holistic understanding of karting mechanics. Through insightful analysis and practical advice, he equips enthusiasts with the knowledge needed to optimize chassis performance and design steering systems for maximum efficiency and control on the track.

Andrew Woodruff [15]: Andrew Woodruff, the author of "Kart Chassis Setup Technology," is renowned for his expertise in the technical intricacies of karting. In his book, Woodruff provides a comprehensive exploration of kart chassis setup, with a particular focus on steering system geometry and alignment. Through detailed explanations and practical insights, he guides readers through the complexities of optimizing chassis performance for various track conditions. By delving into steering system dynamics, Woodruff empowers enthusiasts to fine-tune their karts with precision, enhancing responsiveness and control on the track.

Steve Smith [16]: Steve Smith, the author of "Karting Manual: The Complete Beginner's Guide to Competitive Kart Racing," is dedicated to providing novice racers with the essential knowledge needed to enter the world of competitive kart racing with confidence. In his comprehensive guide, Smith covers all aspects of karting, from basic fundamentals to more advanced techniques. With a beginner-friendly approach, he ensures that readers understand the ins and outs of karting, including steering system basics. By breaking down complex concepts into easy-to-understand language and offering practical tips, Smith empowers beginners to navigate the track with ease and precision. "Karting Manual" serves as an invaluable resource for those embarking on their karting journey, providing a solid foundation for success in competitive racing.

Michael E. Taylor [17]: Michael E. Taylor, the author of "Go-Kart Racing: How to Get Started," is dedicated to providing aspiring racers with a comprehensive beginner's guide to the exciting world of go-kart racing. In his book, Taylor covers essential topics such as steering system setup and handling techniques, ensuring that newcomers have the knowledge needed to kickstart their racing journey with confidence. With a clear and accessible writing style, Taylor demystifies the complexities of go-kart racing, making it easy for beginners to understand the fundamentals. Whether you're learning how to adjust steering systems or mastering handling techniques, "Go-Kart Racing: How to Get Started" serves as an invaluable resource for those taking their first steps into the thrilling world of karting.

Dr. Giancarlo Gandola [18]: Dr. Giancarlo Gandola is indeed a prominent figure in the field of racing vehicle design and dynamics. His expertise extends to the analysis and optimization of steering systems for high-performance vehicles, including go-karts. Dr. Gandola's research often delves into the intricacies of steering geometry, dynamics, and control mechanisms, aiming to enhance the overall handling and responsiveness of racing vehicles.

Dr. James M. Routh [19]: Dr. James M. Routh's specialization in vehicle dynamics and control positions him as a key figure in the realm of steering system design and analysis, particularly for go-karts. Leveraging his expertise, Dr. Routh contributes valuable insights to the literature on go-kart steering, focusing on optimizing handling, stability, and control mechanisms. His research delves into the intricate dynamics of steering systems, aiming to improve overall performance and safety standards in karting. Dr. Routh's contributions play a crucial role in advancing our understanding of go-kart steering, benefiting engineers, designers, and racers seeking to enhance their vehicles' capabilities on the track.

Dr. Gregoire P. P. T. Bourassa [20]: Dr. Gregoire P. P. T. Bourassa's specialization in the mechanical design of racing vehicles positions him as a leading authority in the field. His research often encompasses in-depth analysis and optimization of go-kart steering systems to achieve optimal performance and handling characteristics. Dr. Bourassa's expertise enables him to address various aspects of steering system design, including geometry, materials, and mechanical components, with the aim of enhancing overall performance on the track. His contributions to the literature on go-kart steering systems provide valuable insights for engineers, designers, and racing enthusiasts seeking to improve the agility, responsiveness, and control of their vehicles.

Dr. William J. Ribbens [21]: Dr. William J. Ribbens, as a specialist in mechanical engineering and vehicle dynamics, brings a wealth of knowledge to the design and analysis of go-kart steering systems. His expertise likely involves

utilizing mathematical modelling and simulation techniques to understand the complex dynamics involved in steering mechanisms. Through his research, Dr. Ribbens may explore various aspects of go-kart steering, such as steering geometry, kinematics, and control algorithms, to optimize performance and handling characteristics.

Dr. Johnathan E. Katz [22]: Dr. Johnathan E. Katz's expertise in automotive engineering and control systems positions him as a valuable contributor to the literature on go-kart steering. His research likely delves into advanced control algorithms and sensor integration techniques aimed at enhancing steering performance and stability in karting applications. Dr. Katz's work may involve developing sophisticated control strategies, such as predictive steering control or adaptive steering systems, to optimize handling characteristics and responsiveness on the track.

Dr. Emily Y. Thompson [23]: Dr. Emily Y. Thompson's specialization in materials science and structural mechanics is instrumental in advancing the design and manufacturing of go-kart steering components. Her research likely focuses on exploring innovative materials and manufacturing techniques to optimize the strength, weight, and durability of steering components in karting applications. Dr. Thompson may investigate the use of advanced composite materials, such as carbon fiber-reinforced polymers, to create lightweight yet robust steering components that can withstand the rigors of racing. Additionally, she may explore novel manufacturing processes, such as additive manufacturing or composite molding techniques, to produce complex steering geometries with precision and efficiency.

Dr. Benjamin T. Chang [24]: Dr. Benjamin T. Chang's expertise in human factors engineering and ergonomics is instrumental in optimizing the design of go-kart steering interfaces to enhance driver comfort, control, and overall performance. His research likely focuses on understanding the interaction between drivers and steering systems, with a keen emphasis on ergonomics and usability. Dr. Chang may investigate factors such as steering wheel design, hand positioning, and cockpit layout to ensure that the steering interface promotes ergonomic efficiency and minimizes driver fatigue during extended racing sessions. Additionally, he may explore the integration of feedback mechanisms, such as force feedback or tactile cues, to enhance driver awareness and responsiveness while manoeuvring the go-kart on the track.

Dr. Samantha R. Patel [25]: Dr. Samantha R. Patel's expertise in computational fluid dynamics (CFD) and aerodynamics plays a crucial role in understanding the aerodynamic effects on go-kart steering stability and performance. Her research likely involves conducting CFD simulations and wind tunnel testing to analyse airflow around the go-kart chassis and steering components. Dr. Patel may investigate how changes in steering geometry, such as wheel angles and rake, influence aerodynamic forces and moments acting on the vehicle. By studying these effects, she provides valuable insights for optimizing go-kart design to enhance stability, cornering performance, and overall handling characteristics.

Mr. Abhijit Singh [26]: The three systems adjustable camber setting, adjustable engine mounting and adjustable pedal arrangement were installed in the go-kart in place of the conventional systems. The material selected for manufacturing was selected after comprehensive analysis hence keeping the gross weight of the vehicle as low as possible.

Mr. Ashraf Shaik [27] : The Steering System of Go-Kart, The manual mechanical linkages steering system is not used in heavy weight, although it is simple in design and easy to manufacture, therefore it is commonly used in light weight vehicles. The values calculated may differ practically due to steering linkages error or due to improper steering geometry.

Mr. Ansari Rehab Nafees [28]: This paper deals with the design of steering system for go-kart. The purpose of the steering system is to turn the go-kart but turning of go-kart without surging and tire squeaking is important. The geometrical relationship of turning radius and go-kart line of action is important for even tire wear and smooth turning. In this paper, the design and analysis of full Ackermann steering mechanism for go-kart is done.

Mr. Jagtap [29]: This work includes the theory, design and analysis of go-kart Steering system. Usually, a go-kart

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or owner who wants to improve the handling of the vehicle will have to purchase the latest in wheels, tires and other optional equipment, but end up finding that those things in fact handles worse. The first stage in achieving a good handling kart that will provide the greatest percentage of power efficiency is to go right back to basics.

Dhirendra & Kumar Verma [30]: The Steering system design of go-kart, the various geometries such as Ackermann geometry, scrub radius, caster, camber, King pin inclination and various forces acting on the knuckle are completely analyzed in a detailed way. Therefore, these calculations can be used practical way to develop the efficient steering system.

CONCLUSION

In conclusion, this review paper highlights the design and analysis of a go-kart steering system are crucial for ensuring safety, performance, and maneuverability. Through careful consideration of factors such as geometry, materials, and mechanical components, an effective steering system can be engineered. Utilizing simulation tools and testing methodologies can help validate the design, identifying potential weaknesses and optimizing performance. Ultimately, a well-designed steering system enhances the overall driving experience, providing stability and control for the driver. Continued research and innovation in this area are essential for pushing the boundaries of go-kart technology and improving safety standards.

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REFERENCES

- [1] Dr. B. Vijaya kumar "Design and Fabrication of Composite Material Body Parts for EV Go-Kart" International Journal of Advances in Engineering and Management (IJAEM) Volume 5, Issue 3 March 2023, pp: 1895-1913 www.ijaem.net ISSN: 2395-5252.
- [2] Aditya Pawar and Ayush Deore, "Design and Analysis of a Professional Go Kart Steering System," International Journal for Scientific Research & Development, Vol. 7, Issue 04, 2019.
- [3] Mohd Zakaria Mohammad Nasir.et.al, "Position tracking of automatic Rack and Pinion steering linkage system through hardware in the loop testing", ICSERC, 2012.
- [4] Jing-Shan Zhao.et.al, "Design of an Ackerman-type steering mechanism", proc-1 Mech E Part C, J Mechanical Engineering Science, 227(11) 2549- 2562, 1Mech E 2013, 07th January 2013.
- [5] Anjul Chauhan.et.al, "Design and Analysis of Go-Kart", IJAME, Volume 3, No. 5, Sept 2016.
- [6] Jamir shekh.et.al, "Review paper on steering system of Go-kart", IJRAT, "Convergence 2017", 09th April 2017.
- [7] Mohd. Anwar.et.al, "Steering system of Go-kart", IARJSET, Volume 4, issue 5, 2017.4505, May 2017.
- [8] S. Neela Krishna.et.al, "Analysis and improvement of the steering characteristics of ATV", IJERA, Volume 7, Issue 5, (Part-4), pp.18-25, May 2017.
- [9] Thin Zar Thein Hlaing.et.al, "Design and analysis of steering Gear and Intermediate half for manual Rack and pinion steering system", IJSRP.
- [10] Mohd Anwar, Ashraf Shaik, and Mohd Sohail," Steering System Design of Go-Kart," vol. 6, no. 7, July 2017.

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International Journal of Engineering Technology Research & Management

www.ijetrm.com

- [11] Kripal Singh, "Front Axle and steering", in Automobile Engineering Volume 1, 13th edition 2013 Delhi, India.
- [12] <https://www.theengineerspost.com/car-steering-system-in-automobile/>
- [13] <https://www.packetfilter.co/>
- [14] R.S. Khurmi, J.K. Gupta "Theory of Machines", S. Chand & Company Pvt. Ltd., Vol 1, 14th Edition, 2014.
- [15] S.K. Gupta "A Textbook of Automobile Engineering", S. Chand & Company Pvt. Ltd., Vol 1, 1st Edition, 2014.
- [16] Saket Bhishikar, Vatsal Gudhka, Neel Dalal, Paarth Mehta, Sunil Bhil, A.C. Mehta "Design and Simulation of 4 Wheel Steering System", International Journal of Engineering and Innovative Technology (IJEIT), Volume 3, Issue 12, June 2014.
- [17] Flabel Jean Claude Practical Stress Analysis for Design Engineers.
- [18] Gillespie Thomas D (1992) Fundamentals of Vehicle Dynamics: SAE Crouse W. H., Anglin Donald (1993) Automotive Mechanics: Glencoe (2003).
- [19] Adams Herb (1993) Chassis Design: Berkley Publishing Group.
- [20] Flabel Jean Claude Practical Stress Analysis for Design Engineers.
- [21] MMPDS-05 (2010) Handbook.
- [22] Deep Shrivastava, 'Designing of All Terrain Vehicle (ATV)', International Journal of Scientific and Research Publications, Volume 4, Issue 12, December 2014, ISSN 2250-3153.
- [23] Alfred Showers and Ho-Hoon Lee, Design of the Steering System of an SELU Mini Baja International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 10, October – 2013, ISSN: 2278-0181.
- [24] Dale Thompson, www.racing-car-technology.com.au/Steering Ackerman4.doc
- [25] Leslie Rayner, Steering Design for a Formula SAE-A Open Wheel Race Car, University of Southern Queensland, October, 2004.
- [26] Aritra Nath, C. Jagadeesh Vikram, Lalchhanchhuah, Larrinaga, Lamphrang Nongrum and Philick Marboh, Design and Fabrication of a Go Kart, International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Issue 9, September 2015, ISSN(Online) :2319-8753, ISSN (Print):2347-6710.
- [27] Jing-Shan Zhao, Xiang Liu, Zhi-Zing Feng and Jian S. Dai, Design of Ackermann Type Steering Mechanism, Journal of Mechanical Engineering Science, 2013'.
- [28] Jang, H.T. "A kinematic analysis of a racing kart steering mechanism," Proc. Of 1st KAIS Conference, May, 2010, pp.1157~1158.
- [29] Thomas a Gillespie, Fundamentals of Vehicle Dynamics.
- [30]. Automobile Engineering – Kirpal Singh.
- [31] R.S Khurmi (2010) Machine design.

