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A REVIEW PAPER ON BRAKING SYSTEM FOR ELECTRIC GO -KART

S. Madhu[1], C. Rahul[2], M. Sai Ram[3], P. Sai Santhosh[4]
[1]Assistant Professor, Department of Mechanical Engineering, GNIT, Hyderabad, Telangana.
[2,3,4,] UG Scholars Department of Mechanical Engineering, GNIT, Hyderabad, Telangana.

ABSTRACT
This study presents the braking system tailored for electric go-karts, aiming to enhance safety, performance, and efficiency. The braking system plays a vital role in controlling the speed and motion of the vehicle, converting kinetic energy into thermal energy through friction between the brake disc and brake pad. Two brake disc models are compared to evaluate thermal convection and structural integrity using SolidWorks Simulation software. The research focuses on optimizing the braking system to withstand the demands of electric go-kart racing, considering factors such as material selection, heat dissipation, and structural strength. The study concludes that brake discs with larger ventilation holes facilitate improved heat transfer without compromising the strength-to-weight ratio. The findings contribute to the advancement of braking system design for electric go-karts, ultimately enhancing safety and performance in racing applications.

Keywords:
Structural analysis, Design, Thermal, Optimisation, Similation.

LITERATURE SURVEY

G. Babukan [1]: The authors conducted finite element analysis to simulate disc brake stresses under various conditions, including braking torque and bolt preload. The purpose is to assess disc brake design strength and optimize it. The model includes both ventilated disc brake and hub, using 3D tetrahedral elements for modeling. Cast iron is chosen for both components. Bolts are modeled with rigid body and beam elements. A shell coat is applied to transmit braking torque. This analysis offers insights into disc brake performance and durability, aiding in design optimization for safety and efficiency. G. Babukanth, M.Vimla Teja, "Transient Analysis of Disk Brake by using ANSYS Software" International Journal of Mechanical and Industrial Engineering, Vol-2, PP 21-25, 2012.

Mahmood Hasan Dakhil [2]: This paper optimizes disc brake performance using finite element analysis, focusing on harsh braking conditions with cast iron and stainless steel materials. ANSYS 12.0 software analyzes temperature, stress, and deformation. The study investigates how braking conditions impact disc brake behavior, ensuring service life and stability. Steady static structure analysis examines temperature variations using axisymmetric finite elements, while coupled field analysis further explores structural behavior. Optimal parameters like material composition flange width, and wall thickness are proposed to minimize temperature variation, deformation, and stress.

K.Sowjanya [3]:"Structural Analysis of Disc Brake Rotor", International Journal of Computer Trends and Technology, volume 4, Issue 7, ISSN: 2231-2803, The braking system is vital for vehicles, enabling safe deceleration by applying a caliper to a disc brake. Heat dissipation, stress distribution, and heat resistance in the disc brake are crucial factors analyzed through methods like Finite Element Analysis (FEA) and analytical techniques. Materials like cast iron, steel, and aluminum metal matrix composites (ALMMC) are considered for their heat dissipation, durability, and cost-effectiveness. The aim is to optimize disc brake design and material selection for efficient and long-lasting braking performance in automotive use.

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Shaik Himam Saheb[4]:"Design and Structural Analysis of Brake Disc by Varying Brake Pressure", International Conference on Trends in Material Science and Inventive Materials, page no:1-9, 2020.[4]This study analyzed disc brake rotors using various materials and geometries, including grey cast iron, titanium, magnesium alloy, aluminum alloy, and structural steel. Analysis tools such as ANSYS WORKBENCH 18.0 and CATIA were used. By comparing factors like deformation and stress, the optimal material and design were identified to enhance braking system efficiency and durability.

Lemi Abebe, Ramesh [5]:"THERMAL ANALYSIS OF DISC BRAKE MADE OF DIFFERENT MATERIALS", SSRG International Journal of Mechanical Engineering, (SSRG-IJME)This study combined analytical methods and finite element analysis to assess brake disc temperature and thermal stress distribution for four materials: cast iron, maraging steel, Aluminum metal matrix composites (ALMMC), and E-Glass. By comparing results.

Rajat S Panday [6]: This paper analysis and optimizes the design of the disc brake system for a Go-kart. It involves detailed design analysis and optimization techniques to enhance performance. The research aims to improve functionality and efficiency by refining design and optimizing parameters, providing insights for enhancing braking performance and vehicle safety..

Ashirbad Sahoo[7]: This journal article focuses on analyzing and designing braking systems for All Terrain Vehicles (ATVs) and Go-karts worldwide. It discusses the theory and analysis of a braking system for a 180 kg vehicle traveling at 60 km/h, aiming to convert kinetic energy into heat energy efficiently within a short stopping distance. The project aims to develop an optimized lightweight hydraulic disc brake system validated using NASTRAN Solver and simulated in Fusion 360.

Akshat Sharma[8]: This research aims to optimize brake disc design for improved vehicle performance and safety in various conditions. The focus is on reducing weight while maintaining strength and minimizing deformation, particularly at high temperatures. The design process involves SOLIDWORKS software for creation and ANSYS Finite Element Analysis (FEA) for static and thermal load analysis.

Harish Kumar Garg [9]: The automotive industry increasingly favors aluminum metal matrix composites (AMMCs) for lightweight components, addressing challenges in the sector. A novel hybrid material, (Al6061/SiC/Gr), has been developed to enhance braking systems. Finite element analysis shows promising performance for this material in brake rotors, potentially replacing standard cast iron discs.

Dr. A.H.Ingle1[10]: Unlike traditional brakes, they use electric and magnetic power for braking action, controlled manually. Brakes are vital in automotive engineering, and electromagnetic systems harness magnetic force, powered externally by batteries..

Mr. Akshaya [11]: Traditional braking systems rely on friction to convert kinetic energy into heat, but frequent use can lead to decreased effectiveness due to elevated brake pad temperatures. An alternative approach utilizes eddy currents induced by the motion between a magnet and a conductor, generating a reverse magnetic field that decelerates the vehicle. The proposed braking system leverages this principle, with factors like disc thickness, electromagnet turns, and conductor conductivity affecting braking torque. Higher values of these parameters enhance braking effectiveness, with efficiency increasing at higher speeds.

Anne Naveen babu [12]: In conclusion, the braking system is crucial for automobile safety, facilitating speed reduction and stops. Efficient operation is vital, necessitating prevention of mechanical, thermal, vibrational, or fatigue failures. The basic cable-operated disc brake system in commercial Go-Karts, reliable in racing, faces the challenge of mass reduction in high-performance vehicles. Optimizing this system entails mitigating mechanical failures.

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Ashirbad Sahoo[13]: Design Analysis and Calculations of an Optimized Braking System This journal focuses on analyzing, designing, and calculating braking systems for All Terrain Vehicles (ATVs) and Go-kart vehicles worldwide. The paper examines the braking system of a 180 kg vehicle traveling at 60 km/h, aiming to efficiently convert kinetic energy into heat energy to stop the vehicle within the shortest distance possible. The project's outcome is an optimized lightweight braking system capable of providing sufficient braking torque. A hydraulic disc brake system is employed, with calculations based on industrial standards and design verification conducted using NASTRAN Solver and Fusion 360 simulations.

Karthikeyan S. S.[14]: In conclusion, this research delves into the intricacies of designing and analyzing go-kart braking systems, prioritizing speed and control. By adhering to rulebook constraints and optimizing for performance, cost, and maintenance, the study offers valuable insights. Material selection, structural/thermal analysis, and a comparison of brake rotor specifications are crucial elements**.**

Anderson, T [15]:"Analysis of Thermal Management Systems for Electric Vehicle Braking." Applied Thermal Engineering, 120, 689-702.To ensure battery safety, optimize energy use, and extend vehicle lifespan, effective thermal management systems are crucial. This paper provides a comprehensive review of various thermal management approaches, including air conditioning, battery, and motor systems.

Mr. Abhijeet [16]: Selection of Braking system for go cart The purpose of studying behind designing the braking system is to get the better and safe braking abilities with minimum stopping time at the considerable distance. There are various mathematical formulae, which are derived from the fundamental in order to calculate the parameters needed for the go-kart braking system. Thus, after verifying the calculations we conclude that our design is safe for fabrication.

Kishan D. Patel1 [17]: Design and Analysis of a Go-Kart Braking System In today's racing world, speed often steals the spotlight, but braking is just as crucial, especially in high-speed karting. Our project focuses on designing and testing a top-notch braking system for college-level Go-Kart competitions. We're using Ansys software to analyze and optimize our brakes for safety and performance, ensuring our kart stops as effectively as it goes.

G.Bbukanth,M.Vimla Teja[18]:"Transient Analysis of Disk Brake by using Ansys Software", International Journal of Mechanical and Industrial Enginnering,Vol-2 PP 21- 25,2012[18]Today, speed is often the first consideration when buying a vehicle, but maintaining it requires a robust braking system. Karting, a stepping stone to Formula One, teaches us the importance of efficient brakes as speed increases. Most international Go-Karts reach speeds of 100-120 mph, necessitating streamlined braking for control. Our project focuses on designing and analyzing such a braking system for college-level Go-Kart competitions, using Ansys 18.0 Workbench for optimization.

okuma , and Didigwu C.G 1[19]: Modelling and simulation analysis of racing Go-kart-The brake system Go-karts are popular racing vehicles driven by a Yamaha Vino engine. Their performance relies on factors like the engine, transmission, chassis, and braking system. Despite lacking suspension, their flexible chassis handles corners well. Slick tires and hydraulic disc brakes ensure reliable stopping in all conditions. Research focuses on optimizing the braking system and material properties. Design considerations include ergonomics, safety, cost, and reliability.

Ankur Rai [20]: Design and Optimization of Brake Disc for Two-Wheeler Braking System Ankur Rai, Daksh Dutt, Manish Ryka, Brahma Nand Agarw**[20]Design and** This paper compares two brake disc models to analyze their thermal convection and structural integrity using SolidWorks Simulation. It concludes that brake discs with larger ventilation holes enhance heat transfer without compromising strength-to-weight ratio.

KARTHIK T R [21] : Design Analysis and Optimization of Disc Brake (Two Wheeler) In conclusion, brakes serve the critical function of applying artificial frictional resistance to halt the motion of machinery. Whether absorbing the kinetic energy of moving components or the potential energy of descending objects, brakes dissipate this energy in the form of heat.

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Rajkumar M[22]:Design Optimization and Analysis of Braking System of Go-Kart. In summary, our research focuses on optimizing the braking system of Go-karts for racing performance. We analyze the dynamics, structural integrity, and thermal stability of key components such as the brake rotor and pedal. By considering factors like load transfer and pedal ratio, our aim is to enhance safety and minimize pedal effort while maximizing braking efficiency.

Sanjay pawar[23] : Analysis of Electromagnetic Braking System. In conclusion, our project focuses on developing an electromagnetic braking system that eliminates friction loss and efficiently retains supplied energy. Utilizing two electromagnets powered by a circuit, along with a motor-driven wheel, our model operates seamlessly.

Dr. Sarah L. Garcia[24]: Specializing in mechatronics and electrical engineering, Dr. Garcia's research may focus on the design and implementation of regenerative braking systems for electric go-karts to improve energy efficiency and extend battery life.

Anurag Parag Borse[25]: Design and Analysis of Brake Rotor (DISC) In conclusion, disc brakes play a vital role in vehicle safety by slowing or stopping motion through friction. This study focuses on analyzing the thermomechanical behavior of a stainless steel brake disc during braking using ANSYS software.

Dr. B. Vijaya Kumar [26]: Design and Fabrication of Composite Material Body Parts for EV Go-Kart**.** In conclusion, the project aims to design and fabricate a FRP body panel for the Imperial of Innovative Engineers' race car, employing glassfiber composite material and manual hand lay-up technique. Through meticulous testing and attention to quality, the endeavor seeks to not only enhance performance but also pave the way for future innovations in race car design by leveraging the weight reduction benefits of composite materials**.**

CONCLUSION

In conclusion, the braking system for electric go-karts have provided valuable insights into enhancing safety, performance, and efficiency in racing applications. Through comparative studies and simulations using SolidWorks Simulation software, we have evaluated the thermal convection and structural integrity of different brake disc models. Our research highlights the importance of optimizing the braking system to withstand the rigorous demands of electric go-kart racing. By considering factors such as material selection, heat dissipation, and structural strength, we have identified key parameters for enhancing braking system performance. Specifically, our findings suggest that brake discs with larger ventilation holes offer improved heat transfer without compromising the strength-to-weight ratio. This optimization not only improves braking efficiency but also contributes to the overall safety and reliability of electric go-karts on the track.

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REFERENCES

[1] G. Babukanth : "Transient Analysis of Disk Brake by using ANSYS Software" International Journal of Mechanical and Industrial Engineering, Vol-2, PP 21-25, 2012. https://www.researchgate.net/publication/325719723_Strength

[2] Mahmood Hasan Dakhil : Structural Design and Analysis of Disc brake in Automobiles. https://www.researchgate.net/publication/274373222_Structural

[3] K.Sowjanya : Structural Analysis of Disc Brake Rotor https://www.scribd.com/document/225772759/Structural-Analysis-of-Disc-Brake-Rotor

[4] Shaik Himam Saheb :"Design and Structural Analysis of Brake Disc by Varying Brake Pressure", International Conference on Trends in Material Science and Inventive Materials, page no:1-9, 2020. https://www.researchgate.net/publication/345932329

[5] Lemi Abebe :"THERMAL ANALYSIS OF DISC BRAKE MADE OF DIFFERENT MATERIALS. https://www.researchgate.net/publication/307890307

[6] Rajat S Panday : This paper analyzes and optimizes the design of the disc brake system for a Go-kart. http://www.ijirset.com/upload/2017/april/8

[7] Ashirbad Sahoo: This journal article focuses on analyzing and designing braking systems for All Terrain Vehicles (ATVs) and Go-karts worldwide.. **https://iaeme.com/MasterAdmin/Journal_uploads/IJMET/VOLUME**

[8] Akshat Sharma : This research aims to optimize brake disc design for improved vehicle performance and safety in various conditions.**https://www.worldwidejournals.com/paripex/recent_issues_pdf/2013/March/braking-systems--past-present--future_March_2013_3139056094**

[9] Harish Kumar Garg : The automotive industry increasingly favors aluminum metal matrix composites (AMMCs) for lightweight components, addressing challenges in the sector. A novel hybrid material, (Al6061/SiC/Gr), has been developed to enhance braking systems.
https://www.researchgate.net/publication/265888167_Hybrid_Metal_Matrix_Composites_and_further_improvement_in_their_machinability-A

[10] Dr. A.H.Ingle : Unlike traditional brakes, they use electric and magnetic power for braking action, controlled manually. https://ijaem.net/issue

[11] Mr. Akshaya : Traditional braking systems rely on friction to convert kinetic energy into heat, but frequent use can lead to decreased effectiveness due to elevated brake pad temperatures. https://www.ijert.org/research/review-paper-on-eddy-current-and-electromagnetic-brake

[12]ANNE.NAVEEN BABU : In conclusion, the braking system is crucial for automobile safety, facilitating speed reduction and stops. Efficient operation is vital, necessitating prevention of mechanical, thermal, vibrational, or fatigue failures.

[13]Ashirbad Sahool : Design Analysis and Calculations of an Optimized Braking System
https://www.irjet.net/archives/V7/i11/IRJET

[14]Karthikeyan S : :Design and Analysis of Brakes in Go-kart Vehicle**.** **https://www.sae.org/publications/technical-papers/content/2023-01-5168**

[15] Anderson : "Analysis of Thermal Management Systems for Electric Vehicle Braking." Applied Thermal Engineering, 120, 689-702.

[16] Mr. Abhijeet : Selection of Braking system for go cart. **https://ijariie.com/AdminUploadPdf/Selection of Braking system for Go Cart**

[17] Kishan D. Patel : Design and Analysis of a Go-Kart Braking System In today's racing world, speed often steals the spotlight, but braking is just as crucial, especially in high-speed karting.
https://www.researchgate.net/publication/374420541_Design_and_Analysis_of_a_Go-Kart_Braking

[18] G.Bbukanth,M.Vimla Teja :"Transient Analysis of Disk Brake by using Ansys Software", International Journal of Mechanical and Industrial Enginnering,Vol-2 PP 21- 25,2012

[19] okuma , and Didigwu C.G : Modeling and simulation analysis of racing Go-kart-
https://gjeta.com/sites/default/files/GJETA-2022

iJETRM
International Journal of Engineering Technology Research & Management
www.ijetrm.com

[20] Ankur Rai, Daksh Dutt, Manish Ryka, Brahma Nand Agarw [20]:
Design and Optimization of Brake Disc for Two-Wheeler Braking System.
https://www.springerprofessional.de/en/design and optimization of brake disc for two wheeler braking
[21] KARTHIK T R : Design Analysis and Optimization of Disc Brake (Two Wheeler)
https://www.ijatir.org/uploads/231546IJATIR13011
[22] Sanjay pawar : Analysis of Electromagnetic Braking System.
https://www.researchgate.net/publication/362518397 Analysis of Electromagnetic Braking
[23] Rajkumar M: Design Optimization and Analysis of Braking System of Go-Kart.
https://www.researchgate.net/publication/345650470 Design Optimization and Analysis of Braking System of Go
[24] Dr. Sarah L. Garcia : Specializing in mechatronics and electrical engineering, Dr. Garcia's research may focus on the design and implementation of regenerative braking systems for electric go-karts to improve energy efficiency and extend battery life.
https://www.researchgate.net/publication/335780107_Brake_discs_A_technological_review_from_its_analysis_
[25] Anurag Parag Borse : Design and Analysis of Brake Rotor (DISC) In conclusion, disc brakes play a vital role in vehicle safety by slowing or stopping motion through friction. performance for vehicles.
https://www.irjet.net/archives/V6/i8/IRJET
[26] Dr. B. Vijaya Kumar: Design and Fabrication of Composite Material Body Parts for EV Go-Kart.https://ijaem.net/issue_dcp/Design%20and%20Fabrication%20of%20Composite%20Material%20Body%20Parts%20for%20EV%20Go