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Modeling and Analysis of Driven Shaft with Composite Materials

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Abstract: *This study deals with the review of the optimization of drive shafts using ANSYS. The substitution of composite material over regular steel material for the drive shaft has expanded the upsides of the outline because of its high particular firmness and quality. The drive shaft is the primary part of the drive arrangement of a vehicle. The utilization of traditional steel for assembling drive shafts has many impediments, for example, low particular firmness and quality. Regular drive shaft is made up of two sections to build its major common twisting recurrence. A two-piece drive shaft expands the heaviness of the drive shaft which is not alluring in the present market. Numerous strategies are accessible at display for the plan advancement of basic frameworks and these strategies are in view of scientific programming procedures including slope look and direct inquiry. These techniques expect that the plan factors are persistent. Be that as it may, in useful basic building improvement, all the plan factors are discrete. This is because of the accessibility of segments in standard sizes and imperatives because of development and assembling rehearses. This paper talks about the past work done on composite drive shafts utilizing ANSYS*

Keywords: Parts, Assembly, Drawing, Gray Cast Iron, Epoxy E-Glass UD

I. INTRODUCTION

REVIEW PAPER

Ravi Sekhar [1]

MMC's can be machined by many conventional machining processes such as turning, milling, drilling, tapping, grinding, honing, sawing, etc. But results shows huge amount of tool wear, poor machineability, poor surface quality, low accuracy, more cutting force required which restricts MMC's to be machined by conventional manufacturing processes so, most of authors recommended nonconventional machining process of machine MMC's [1,3,4,7,8,26,27,28,29,31,33,76].

Court brown CM, Mc birnie J. J Bone Joint Surg Br [2]

Developing biomaterials for bone repairs is a challenge for med ical science as well as from an engineering point of view for the design of prostheses. Conventional metallic prostheses have a long history but are becoming obsolete due to various disadvantages. Composite materials are getting more attention in the engineering eld for development of high-performance implants to enhance the healing of bone fractures, and more ef cient function-oriented composite materials such as resorbable/biodegradable and bioac tive composites are being developed to meet the required perfor mance characteristics of orthopedic prostheses and implants.

Watson and Xiang[3] used power signal to detect generator rotor misalignment and bearing faults using both FFT and wavelet analysis. Wavelet analysis was used to produce time-frequency representation of non-stationary signals. FFT analysis was used to determine the amplitude of the harmonic components more accurately, and thus to help find the peak amplitude spectrum of the wavelet coefficients during the given time period, which can be used as the fault signature. The results showed success in identifying early stage of failures. The authors stated that a variable loading on one hand presents difficulty for condition monitoring; while on the other hand, can excite a range of modes within a wind turbine and potentially provide rich information about the turbine health condition.

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Akhand Rai [4]
Frequency characteristics of the signal to identify the raw signal or the signal can be processed signal. For example, to obtain a spectrum envelope signal a procedure was well established [28] which separated other machine elements by vibration generated by the vibration generated by a defective component. The amplitude spectrum is the square of the amplitude of the power spectrum.
Sreenivasan R [5]
The energy consumption in casting is normally proportional to the mass of the part produced, because the energy required to melt the material dominates. PM has the lowest energy consumption per unit mass and has a high raw material utilization, over 95%. These energy savings alone contribute considerably to the economic advantage offered by PM.
Gummadi Sanjay Akula Jagadeesh Kumar [6] Composites have high specific modulus, strength and less weight. The fundamental natural frequency of carbon fiber drive shaft can be twice as that of the steel or aluminium, because the carbon fiber composite material has more than 4 times the specific stiffness, which makes it possible to manufacture the drive shaft of passenger cars in one piece. A one piece composite shaft can be manufactured so as to satisfy the vibration requirements. This eliminates all the assembly, connecting the two piece steel shaft and thus minimizes the overall weight, vibrations and cost. Due to weight reduction fuel consumption will be reduced. They have high damping capacity and hence they produce less vibrations and noise. They have good corrosion resistance, greater torque capacity, longer fatigue life than steel and aluminium.
John. W [7] Many methods are used for the design optimization that assumes all the design variables are continuous. But in actual structural optimization almost all the variables are discrete. The GA is a stochastic global search method that mimics the metaphor of natural biological evolution. GA operates on a population of potential solutions applying the principle of survival of the fittest to produce (hopefully) better and better approximations to a solution. At each generation, a new set of approximations is created by the process of selecting individuals according to their level of fitness in the problem domain and breeding them together using operators borrowed from natural genetics.
D. Gay, S. V. Hoa, S. W. Tsai [8] When the length of a steel drive shaft goes beyond 1500 mm, it is manufactured in two pieces to increase the fundamental natural frequency, which is inversely proportional to the square of the length and proportional to the square root of the specific modulus. The nature of composites, with their higher specific elastic modulus, which in carbon/epoxy exceeds four times that of aluminum, enables the replacement of the two-piece metal shaft with a single-component composite shaft which resonates at a higher rotational speed, and ultimately maintains a higher margin of safety. A composite drive shaft offers excellent vibration damping, cabin comfort, reduction of wear on drivetrain components and increases tire traction.
Bauchau O A, Krafchack T M, Hayes J F [9] In the drive line application the torque produced in the engine has to be transferred to the rear wheels to move the vehicle. For realistic driveshaft system, improved lateral stability characteristics must be achieved together with improved torque carrying capabilities. In recent years research is going on to replace a two piece drive shaft with a single piece shaft without sacrificing the functional requirements. As the single piece drive shaft is long and thin walled, the failure mode is torsional buckling rather than material failure.
A. Khalkhali [10] Power transmission drive shafts have many industrial applications, such as in vehicles, cooling towers, pumping sets, aerospace, structures and etc. Drive shaft length is limited by its critical speed. Since the fundamental bending natural frequency of a one-piece metal drive shaft is normally lower than 5700 rpm (95 Hz) when the length of the drive shaft is around 1.5 m
Anantharaman K et al. [11] (2002) deals with the designed drive shafts are optimized using GA and analysed using ANSYS for better stacking sequence, better torque transmission capacity and bending vibration characteristics. The usage of composite materials and optimization techniques has resulted in considerable amount of weight when compared to steel shaft and suggest that GA can be used effectively and efficiently in other complex and realistic designs often encountered in engineering applications.
O. Montagnier [12] These methods are unsuitable in the case of composite laminates, however, because many of the variables which have to be op timised are discrete variables (such as the number of plies and the ply angle in prepreg lay-up processes). It is therefore necessary to assume these variables to be continuous to be able to compute the

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gradients required. The optimisation techniques available for solvling problems involving discrete variables are known as metaheur istic methods. For example, Gubran and Gupt.

Zindel [13] Flexible matrix composites are materials that consist of high sti ness and strength bers embedded in a soft and exible matrix which exhibits a high failure strain. Considering a UD reinforced FMC, the ratio of transverse moduli of elasticity can be up to 105 whereas this ratio is typically in the range between 10−102 for RMC. Hence, this higher degree of anisotropy allows for more design exibility and properties can be tailored to speci c needs (Zindel (2009)).

Shaw D, Simitses DJ, Sheinman [14] Drive shafts for power transmission are used in many applica tions, including cooling towers, pumping sets, aerospace, struc tures, and automobiles. In metallic shaft design, knowing the torque and the allowable service shear stress for the material al lows the size of the shafts cross-section to be determined. In order to satisfy the design parameter of torque divided by the allowable shear stress.

D.J Bieryla[15] ., Substituting composite structures for conventional metallic structures has much advantage because of higher specific stiffness and strength of composite materials. This work deals with replacement of conventional two piece steel drive shaft with a single-piece e glass/epoxy, high strength carbon/epoxy and high modulus carbon/epoxy composite drive shaft for automobile shaft for an automotive application. According to this paper it is found that optimum fiber angle orientation will play important role in composite shaft which depends on requirement of composite shaft.

Ruddy BL [16] The piston ring is the most complicated tribological component in the internal combustion engine to ana lyze because of large variations of load, speed, tem perature and lubricant availability. In one single stroke of the piston, the piston ring interface with the cylinder wall may experience boundary, mixed and full fluid f ilm lubrication

Pawan Kumar Patel et al. [17] studied comparative analysis of spur gear using different material such as alloy, gray cast iron, carbon fibre, Epoxy carbon and Epoxy E glass was used. All these materials were tasted as contact stresses were developed after loading. A CAD model was developed in CATIA V5-6R 2017 and statistical structural analysis also performed. This practical and numerical data was compared after validation material was analysed in ANSYS.

D. Capanidis,[18]

The ABAQUS system enabled also the modelling of the contact of the collaborating surfaces by means of the algorithm characteristic for that system. The contact has been assumed in the contact area of the teeth on the inlet side of the gear system. Friction coefficient m for the contact has been selected considering the kind of plastic and the conditions in the area of the contact (high stress, for instance). The value of the friction coefficient m = 0.4 has been determined on the basis of research.

Rendell et al. [19] give a review of two Flywheel Generator Converters (FGCs) used by Joint European Torus (JET), each ywheel supply 2600MJ (722 kWh) to their respective magnet load coils to supplement the 575MW (pulsed) grid supply. These ywheels have been in service for 30 years since 1983 and provided for approximately 85,000 JET pulses.

Arani et al. [20] present the modeling and control of an induction machine-based wheel energy storage system for frequency regulation after micro-grid islanding.

II. CONCLUSION

In this investigation, To assess a few tube-shaped composite shafts via carbon overlay approach. The work has focused on extreme quality, unwavering quality with the least material utilization, Change of cover stacking succession and sheet winding generation process result in a definitive quality going 20% higher than regular idea shaft.

The transient analysis has done on the given driven shaft by changing with different materials like Grey Cast Iron, structural steel and Epoxy E-Glass fiber. The analysis is carried out by taking different loading conditions when the body in dynamic nature and stacking process is also helpful for enhancing the lifetime survival of driven shaft ..

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