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EMERGING TRENDS IN AUTOMOTIVE ENGINEERING

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Abstract

The trends in design and development in automobile to realize sustainable mobility, while enhancing the effort fun and excitement has been highlighted. The benefit and challenges of sustainable advanced technologies are discussed. Automotive engineering has been working on various technologies such as light weighting, electrification of powertrains and safety features (anti-lock breaking system (ABS), electronic break force distribution (EBD), hybrid vehicles, fuel cells, infrastructure after marketing and service. These are increasingly finding their way into Indian vehicles as well. While these development do pose a host of challenges, they also open a lot of interesting opportunities for the Indian automotive sector. The sector covers witnessing significant changes in line with the global industry. Fuel efficiency (lowering the cost of operating a vehicle) has always been a key factor for Indian customers. However emission and safety have also assumed greater importance, in line with global trends. National electric mobility mission plan (NEMMP) 2020 was launched by the government to provide demand side incentives with R&D focus, faster adoption and manufacturing of hybrid and electric vehicles (Fame India) to increase the adoption of electric and hybrid vehicles in India. In this paper we meet the huge sustainability challenge that is the industry must become more proactive and the accounts of emerging trends in vehicle.

Keywords: Fuel emission, AMT, ABS, CMBS, Night vision, Autonomous car

1. INTRODUCTION

Automotive engineering” One of the biggest trends in automotive engineering is improving engine efficiency and fuel economy.” Automotive engineering is a branch of study of engineering which teaches manufacturing, designing, mechanical mechanisms as well operations of automobiles. it is an introduction to vehicle engineering which deals with motorcycle ,cars , buses , trucks etc. it includes branch study of mechanical , electronic, software and safety elements .some of the engineering attributes and disciplines that are important to the automotive engineering and many of the other aspects are include in it. Such as safety engineering ,fuel economy or emission , vehicle electronics , performance, shift quality , durability ,drivability, cost ,program timing assembly feasibility, quality managements etc. the Indian automobile industry has seen significant evolution in the last three to four decades . In the 1970’s India was a close market with a restrictive regulatory environment and growth was limited by supply outdated auto models, high duties and sales taxes .post liberalization, the automotive sector was licenced with automatic approval for foreign direct investment (FDI) up to 100 equity .this period also saw an entry of the key automotive OEMs and suppliers into the Indian market through organic or inorganic routes. Today Indian consumers have guest of choices and automotive

companies are designing vehicles from ground up and taking them to other markets.

1. 1 Safety

According to a UN report, there are more than 200,000 road accidents fatalities in India every year .to address this, the government has been taking step to review safety regulation. The centre also constituted a committee on the road safety and traffic management in 2005 and approval the national road safety policy in 2010 to take the concrete measures.

Several developed countries have regulations for mandatory recall of vehicles if defects are found and reported by the consumers. Currently, vehicle manufacturers in India make voluntary recalls are huge financial burdens for the automakers. The new road transport and safety bill highlights that if 100 or more peoples complain about particular defect in a vehicle that could cause harm to occupants or other road users to the Vehicle Regulation and Safety Authority then the authority can order a recall. Indian government initiates improve road safety is the plan to launch the Bharat new vehicle safety assessment programme (BNVSAP). It is in the Indian version of the global new car assessment programme (NCAP) wherein cars would receive star rating based on a safety features the programme would include frontal and rare crash test and require compulsory safety features like ABS and Airbags. BNVSAP is likely to be mandated for all cars

manufactured from 2017 while the existing models would have time till 2018.

Safety engineering is the assessment of various crash scenarios and their impact on the vehicle occupants. These are tested against very stringent government regulation. Some of these requirements include: seat belt, air bags, functionality testing, front and side impact testing and test of roll over resistance assessments are done with various methods.



Fig-1: Visualization of asymmetrical crashing test

1.1.1 Pre-Collision Technology



Fig-2: Pre-collision Throttle Management

Obstacle collision avoidance system (OCAS) is an automobile safety system for avoiding a collision or significantly reducing its severity. The system detects impending collisions via radar technology, and takes appropriate preventive action.

Top carmakers such as Hyundai and Ford have developed a pre-collision assist and pedestrian detection technology besides helping the driver detect blind spots, this technology also alerts the driver when he/she is not paying attention on the road. And if the driver falls asleep and does not responding to the warning then the system applies the brake on its own. The driver assist system has 2 types of sensors. One is millimetre wave radar located inside the front grille, and the other is a monocular camera mounted on the upper, inside part of the windshield. Its collision mitigation braking system (CMBS) delivers an audio and visual warning when there is a risk of head on collision.

If the driver fails to react the car will automatically begin braking itself to prevent or reduce the severity of a crash. This technology has debut in 2015 with Ford Mondeo in Europe.

1.1.2 V2V Communication

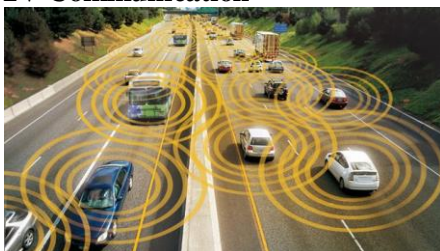


Fig-3: Vehicle to vehicle communication

Vehicle-to-vehicle (V2V) is an automobile technology designed to allow automobiles to "talk" to each other. V2V communications form a wireless ad hoc network on the roads. Such networks are also referred to as vehicular ad hoc networks, VANETs. The systems will use a region of the 5.9 GHz band set aside by the United States Congress, the unlicensed frequency also used by Wi-Fi. The US V2V standard, commonly known as WAVE ("Wireless Access for Vehicular Environments"), builds upon the lower-level IEEE 802.11p standard, as early as 2004.

In February, US national highway traffic safety announced that will begin taking steps to enable V2V communication technology for light vehicles. This technology would allow vehicles to "talk" to each other and ultimately avoid many crashes altogether by exchanging basic safety data, such as speed and position, ten times per second, to improve safety.

1.1.3 Night Vision With Pedestrian Detection



Fig-4: Automotive night vision

An automotive night vision system uses a thermographic camera to increase a driver's perception and seeing distance in darkness or poor weather beyond the reach of the vehicle's headlights. Such systems are offered as optional equipment on certain premium vehicles. The first introduction was in 2000 on Cadillac Deville. It uses a thermal imaging camera design the four rings at the front of the cars which can see 300 metres (984 feet) ahead. The display in the instrument cluster highlights humans with yellow markings.

2. FUEL EMISSION



Fig-6: Hyundai's next-generation hydrogen-powered car.

The Indian government has been taking steps, such as launching of an air quality index for several cities for real-time monitoring and to create awareness about pollution.

Currently, the Bharat stage III emission standard is mandated throughout the country to regulate air pollutants. Recently Bharat stage IV standard that is active in select cities, has resulted in vehicle manufacturers investing in new engine upgrades and advanced technology. Future standards such as Bharat

stage V and VI are likely to be mandated in the near future

The Bureau of Energy Efficiency (BEE) had already notified new norms under the Corporate Average Fuel Consumption (CAFC) policy, which is implemented would mandate a mileage increase of about 14 per cent for all passenger vehicles from 2016-2017. Fuel economy is the measured fuel efficiency of the vehicle in miles per gallon or kilometres per litre. Emissions testing includes the measurement of vehicle emissions, including nitrogen oxides (NOx), carbon monoxide (CO), carbon dioxide (CO2), and evaporative emissions. NVH engineering (noise, vibration, and harshness): NVH is the customer's feedback (both tactile [felt] and audible [heard]) from the vehicle. While sound can be interpreted as a rattle, a tactile response can be seat vibration or a buzz in the steering wheel. This feedback is generated by components either rubbing, vibrating, or rotating.

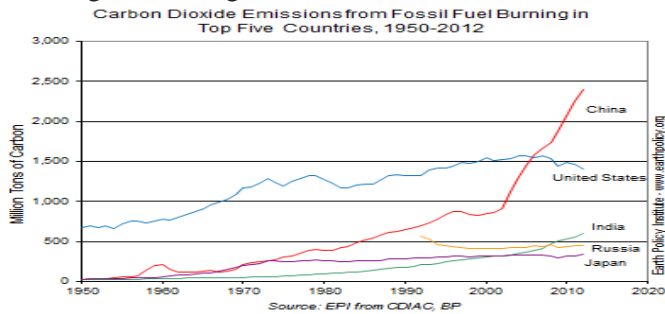


Fig-7: Suggested Fuel emission in future

3. LIGHTWEIGHTENING

As the weight of a vehicle directly impacts its dynamics, agility, fuel consumption and CO2 emissions, it is being drawing the attention of the automotive industry for decades now. Light weighting strategies today are a combination of component design, manufacturing process innovation and substitution of materials. Leading car manufacturers in India have been targeting light weighting with materials such as aluminium, magnesium alloy, high performance engineering plastics and high strength steel. Vehicle manufacturers have to align with Tier I and II suppliers to achieve the desired results. One such sector is aviation and aerospace. Cross industry exchange from aviation to the automotive industry has increased the pace of adoption of advanced materials. A faster learning curve could be possible if knowledge of composite design, crash simulation, recyclability, material failure mechanism and assembly technologies is transferred from the aviation to the automotive industry.

Material used	Advantages	Challenges
High strength steel(engine body works)	Makes use of existing vehicle manufacturing infrastructure	Comparatively lower strength to weight ratio

Aluminium(engines)	Easy to form and recycle	Harder to spot – weld Uses labour intensive adhesive bonding
Magnesium alloy (transfer casing, car seat frame, steering column, steering wheel core).	Low density and good strength to weight ratio	Low – High temperature strength, poor corrosion resistance.
Glass fibre reinforced composites (suspension, springs, sub-assemblies of pedals and mechanical linkages)	Part can be consolidated so that less assembly time is required	Long production time Cannot be recycled
Carbon fibres reinforced composites (vehicle body and vehicle parts)	Highest strength to weight ratio	Very high cost of carbon fibres

4. PERFORMANCE

Performance is a measurable and testable value of a vehicle's it is an ability to perform in various conditions. Performance can be considered in a wide variety of tasks, but it's generally associated with how quickly a car can accelerate (e.g. standing start 0.25 mile elapsed time, approx.. 60mph, etc.), its top speed, how short and quickly a car can come to a complete stop from a set speed (e.g. 70-0 mph), how much g-force a car can generate without losing grip, recorded lap times, cornering speed, brake fade, etc.

5. SHIFT QUALITY

(felt) and audible (heard) response of the vehicle. Shift quality is experienced as various events: Transmission shifts are felt as an upshift at acceleration (1–2), or a downshift manoeuvre

It is the driver's perception of the vehicle to an automatic transmission shift event. This is influenced by the powertrain (engine, transmission), and the vehicle (driveline, suspension, engine and powertrain mounts, etc.) Shift feel is both a tactile in passing (4–2). Shift engagements of the vehicle are also evaluated, as in Park to Reverse, etc.

6. DRIVABILITY

The Indian automotive industry is witnessing testing times. The market continues to experience volatility and we are waiting to see clear signals of revival in growth. With the government and the judiciary taking steps to make transport cleaner and safer, there is some degree of uncertainty for automakers, especially regarding the fuel

mix and the necessary investment for technology upgrades. We believe that these are just short term challenges as the long term growth story for the automotive industry in India remains intact.

7. COST

Vehicle's cost program is typically split into the effect on the variable cost of the vehicle, and the up-front tooling and fixed costs associated with developing the vehicle. There are also costs associated with warranty reductions and marketing.

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