CAR TECHNOLOGY WORKSHOP

TECHFEST 2004

Design:

Defining shape and form of a Car

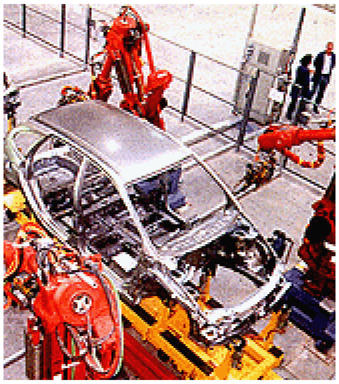
1. Ensuring System integrity of product.
2. Create foundation for defining geometric Quality checks to ensure product quality.
3. Reducing product development costs by resolving packaging and manufacturing issues without making a prototype.
4. Reducing product development time by digitally designing product variants right in the product crystallization phase

Chassis Design

A chassis is the supporting frame of a car. It gives the car strength and rigidity, and helps increase the car's crash-resistance through energy absorption. If a car were a human body, the chassis would be the skeleton. During a fall, a person with strong bones is likely to be hurt less than someone with weak bones. The same goes for a car in an accident. The chassis helps keep a vehicle rigid. A strong chassis will keep the back end of a car from falling out of alignment with the front end, while remaining as stiff and unbending as possible.

The chassis is especially important in ensuring low levels of noise, vibration, and harshness (NVH) throughout the vehicle. Not only does a reduction in NVH allow for a more pleasant driving experience, but by putting less stress on connecting components it can help increase the life span of these components. The key determinant permitting reduced levels of NVH is energy absorption. By having a high level of energy absorption, NVH levels are lowered, but more importantly, passenger protection can be enhanced in the event of a collision.

Body Design:



The body of an automobile is categorized according to the number of doors, the arrangement of seats, and the roof structure. Their roofs are conventionally supported by pillars on each side of the body in recent times, there are convertible models with retractable fabric tops that rely on the pillar at the side of the windshield for upper body strength, as convertible mechanisms and glass areas are essentially nonstructural. The glass areas have been increased for improved visibility and for aesthetic reasons. New designs are usually programmed on three- to six-year cycles with generally minor refinements appearing during the cycle.

Redesigning was a tough job in the past, when as much as four years of planning and new tool purchasing was needed for a completely new design. Computer-aided design (CAD) and computer-aided manufacturing (CAM) techniques may now be used to reduce this time requirement by 50 percent or more.

Sheet steel is generally used to make automotive bodies. Elements are added to the alloy to improve its ability to be formed into deeper depressions without wrinkling or tearing in manufacturing presses. Steel is used because of its general availability, low cost, and good workability. Other materials for certain other materials are also used. Other materials, such as aluminum, fiberglass, and carbon fiber reinforced plastic are used because of their special properties.

For more toughness and resistance to brittle deformation, Polyamide, polyester, polystyrene, polypropylene, and ethylene plastics have been formulated. Tooling for plastic components generally costs less and requires less time to develop than that for steel components.

Painting and priming processes are used to protect bodies from corrosive elements and to maintain their strength and appearance. Bodies are first dipped in cleaning baths to remove oil and other foreign matter and then they go through a succession of dip and spray cycles. Enamel and acrylic lacquer are both in common use.

Electrodeposition of the sprayed paint, a process in which the paint spray is given an electrostatic charge and then attracted to the surface by a high voltage, helps assure that an even coat is applied and that hard-to-reach areas are covered. To speed up the drying process in the factories, ovens with conveyer lines are used. In those body areas that are more susceptible to corrode, galvanized steel with a protective zinc coating and corrosion-resistant stainless steel are used

Transmission:

An automatic transmission contains two major components: a fluid coupling that controls the transfer of torque from the engine to the rest of the transmission and a gearbox that controls the mechanical advantage between the engine and the wheels. The fluid coupling resembles two fans with a liquid circulating between them. The engine turns one fan, technically known as an "impeller," and this impeller pushes transmission fluid toward the second impeller. As the liquid flows through the second impeller, it exerts a twist (a "torque") on the impeller. If the car is moving or is allowed to move, this torque will cause the impeller to turn and, with it, the wheels of the car. If, however, the car is stopped and the brake is on, the transmission fluid will flow through the second impeller without effect. Overall, the fluid coupling allows the efficient transfer of power from the engine to the wheels without any direct mechanical linkage that would cause trouble when the car comes to a stop.

Between the second impeller and the wheels is a gearbox. The second impeller of the fluid coupling causes several of the gears in this box to turn and they, in turn, cause other gears to turn. Eventually, this system of gears causes the wheels of the car to turn. Along with these gears are several friction plates that can be brought into contact with one another by the transmission to change the relative rotation rates between the second impeller and the car's wheels. These changes in relative rotation rate give the car the variable mechanical advantage it needs to be able to both climb steep hills and drive fast on flat roadways.

Finally, some cars combine parts of the gear box with the fluid coupling in what is called a "torque converter." Here the two impellers in the fluid coupling have different shapes so that they naturally turn at different rates. This asymmetric arrangement eliminates the need for some gears in the gearbox itself.

Suspension:

The role of the suspension is to maintain at all times a contact between the wheels and the track and ensure that the car weight is always equally shared by the four wheels. Not an easy task, since the speeds and centrifugal accelerations are very high (around 1G during turns). Several physical factors come into the equation:

- The stiffness represents the vertical force to exert on the suspension to push the car down. It is fixed by the characteristics of the springs.
- Damping is the speed with which the vertical oscillatory movement stops. It is controlled by the shocks. Damping a suspension is done by turning the kinetic energy into heat. This is done inside the shocks and induces extremely high level of stress.
- The weight transfer being present during any acceleration or deceleration. In a left turn on a banked track, a mass proportional to the centrifugal acceleration is removed from rear left wheel, while the same mass is added to the front right wheel. The two other wheels see a lower amount of weight transfer. This can be partially compensated by putting more weight on the left rear wheel. However, this in turn deteriorates the car handling in the straights and decreases the top speed.

Adjusting the suspension consists in playing with these three parameters at every track. The important track factors are as follows:

- The ratio between the length of the straights and that of the turns determines a starting point for the left and rear bias to obtain a good handling on the overall track, as well as the wheel stagger value.
- The banking angle modifies the vertical component of the force produced by centrifugal acceleration and is compensated by modifying the stiffness of the springs.
- The progressivity of passing from the banked area to the non-banked area and reverse provokes slower or faster vertical displacements of the suspension. This is compensated byadjusting the damping factor (also called stiffness) of the shocks.