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FSAE Racing Gear Selection and Shifting Agencies Choose to Discuss the Impact of Car Drivers

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Abstract. FSC is a Formula One car contest car works by the universities or auto-related professional school students team up to participate in the design and manufacture of automotive competition. All participating teams in accordance with the rules and race car manufacturing standards, in a year's time to design and manufacture an accelerating, braking, handling, and so has excellent performance of small single-seater racing leisure, to successfully complete all or Part of the event part of the game. This article discusses the transmission of choice for car drivers.

Introduction

FSC, which is the abbreviated form of Formula Student China, is a competition about design and manufacturing of racecar. The team members in the competition are university and college students whose majors are about automotive engineering. A racecar can be divided into 8 different systems, braking, engine power train, chassis and body, electric system, painting, steering, suspension, wheels and tyres. The design of every single system requires professional knowledge, especially when it comes to the choice and match of the gearbox. Gearbox is the major part of the transmission system in a racecar and it will evidently influence the performance of a racecar and the driver. There is no requirement about gearbox in Formula Student's rules. This article will introduce the influences of different gearbox on the racecar driver.

Analysis of the optional gearbox in FSAE

According to the FSAE rules, any form of transmission gear can be used in a FSAE racecar.

Options of gearbox

After research, we know that there are two different types of gearbox that is suitable for FSAE racecar.

Sequential Gearbox

Sequential gearbox is the most common gearbox in motorcycle. Sequential gearbox's full name is sequential manual gearbox and it's also known as spur gear gearbox. The operation of sequential gearbox and common car manual gearbox are different. You only need to push the shift rod backward and forward to shift up and down when using a sequential gearbox.

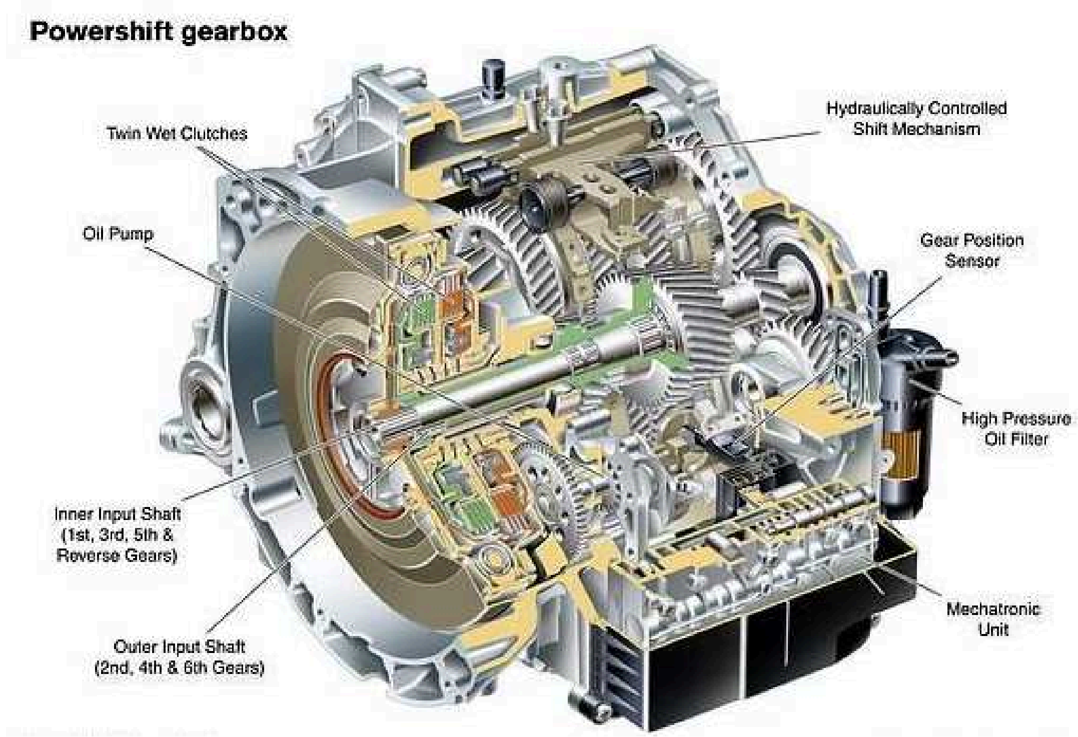

Fig. 1 Sequential Gearbox

Continuously Variable Transmission (CVT)

CVT is a new concept of gearbox. It is composed of conical ratchets and steel belt but gears. The driving ratchet and driven ratchet are connected by steel belt. The width of the groove in the middle of the ratchet is changeable. When the ratchet becomes wider, the steel belt will embed itself deeper into the groove of the ratchet. At the same time, the steel belt near the axis of the ratchet is push toward the edge of the ratchet, away from the axis of the ratchet. The gear ratio is changing according to the distance between the steel belt and the axis of the ratchet. What's outstanding about CVT is that it can achieve stepless gear ratio change. While the number of gear ratios is limited in traditional gearbox because it's limited by the tooth number of the gear.

The influence of different gearbox on racecar drivers

FSAE racecar is a small-sized single-seater with great acceleration, braking and handling performance. Most of the people who drive this kind of racecar are racing amateurs and they have no professional skill. So the selection of gearbox has a crucial influence on the driver.

The influence of sequential gearbox on racecar drivers

Sequential gearbox can reduce power loss of the transmission system because its synchronizerless spur gear structure. It will increase the shifting speed without the possibility of shift miss. It takes less effort to use the short-stroke shift rod of a sequential gearbox. And it adds more fun to driving.

The operation of sequential gearbox is as follow:

Clutch is used only when start and stop.

Step on the clutch before start, pull the shift rod to shift into the first gear, slowly release the clutch while give it some gas, then the racecar will start to go.

If you want to shift up after starting, pull the shift rod while quickly release the throttle. You should repeat the same process when you want to shift up.

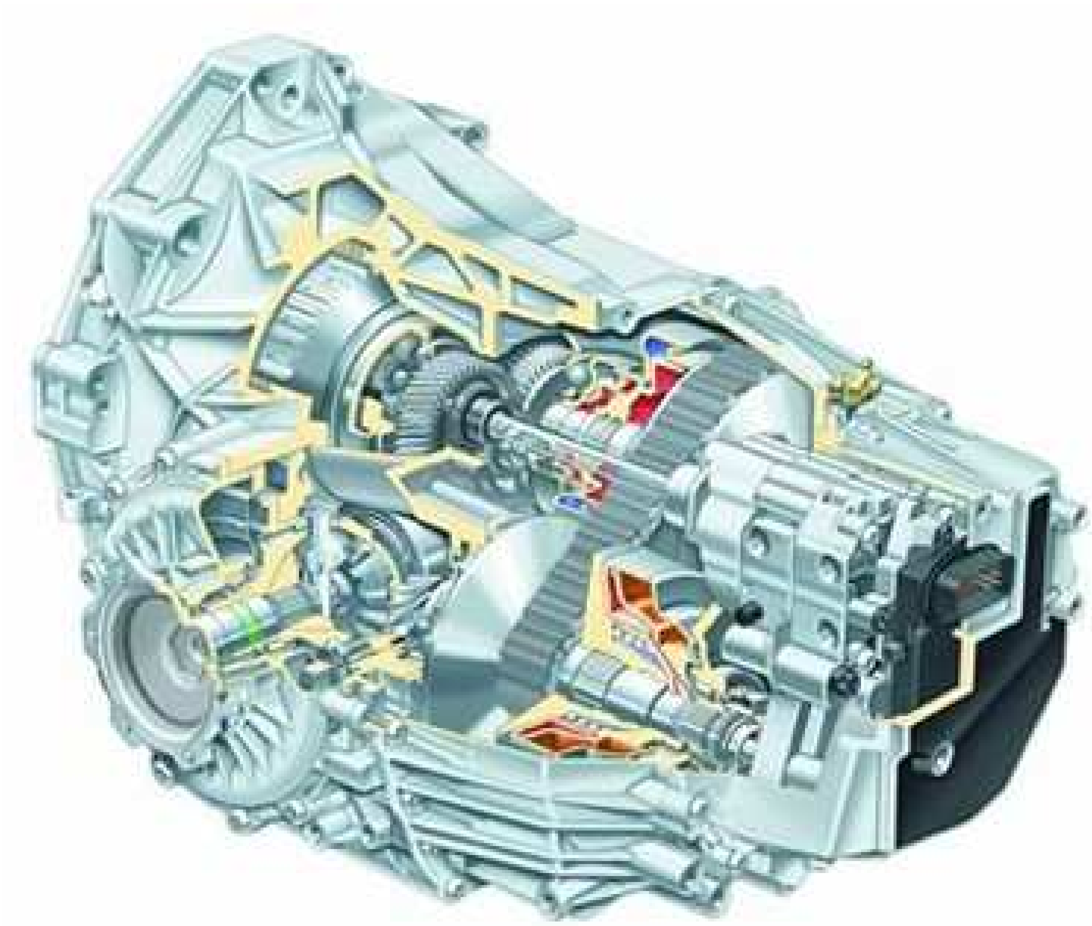

Fig. 2 Continuously Variable Transmission

When the racecar hits the breaking point, use your left foot to brake and release your right foot that stepping on the throttle. When the car have slow down to a suitable speed, you should push the shift rod to shift down while give the throttle a tap with your right foot. That tap is about 20% of the whole travel of the throttle. During this process, you should keep braking and shift down in the same way.

We can see from above that sequential gearbox requires a pretty high level of skill from the driver.

Electronic sequential gearbox is easier to control than mechanical sequential gearbox. Its shifting is control by an electronic system, which will free you from push the shift rod. When it's time to shift up, electronic fuel injection system will receive a shifting signal from the sensor then it will cut the ignition of the engine. When it's time to shift down, EFI will receive a shifting signal from the sensor then it will instantly increase the fuel-injection quantity to simulate the movement of tapping throttle. But the way electronic sequential gearbox start and stop is the same as mechanical sequential gearbox.

Electronic sequential gearbox has a much lower skill requirement than mechanical sequential gearbox. Nevertheless, driver still has to know the shifting timing well to exploit the performance of the racecar.

The influence of CVT on racecar drivers

CVT can achieve stepless speed change in a pretty wide range, so as to make the engine working condition and transmission system match well. The control system of the engine and CVT is closed-loop, that way it can mobilize the engine's max torque and the racecar will gain torque evidently through decelerating. Racecar driver can use left foot braking as CVT has no clutch.

As you can see, the skill requirement of CVT for drivers is not so high, and it allows drivers to enjoy driving a FSAE racecar.

Conclusion

This article discusses the influences of two kinds of gearbox that widely used in FSAE. The skill requirement of CVT for drivers is not so high and it can exploit the performance of the racecar. Sequential gearbox, no matter mechanical or electronic, has a requirement of a high level of skill from the driver.

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