

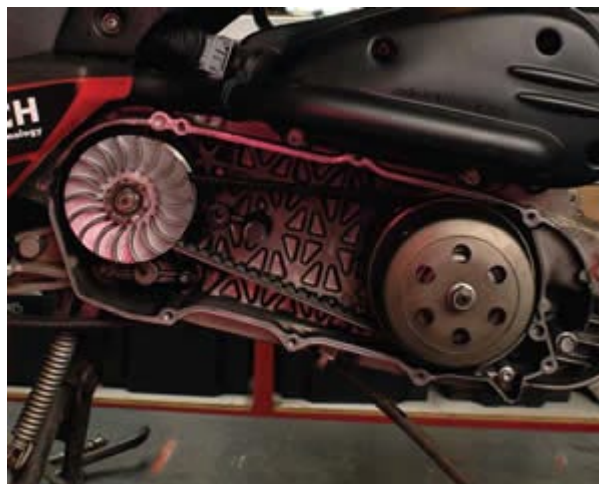
Continuously Variable Transmission CVT

How does it work?



Scooters were meant to be easy and so a lot of complication has gone into making them simple. Here's how to demystify the transmission without even getting your hands dirty

The biggest development in the scooter world since, well the scooter world began is the now ubiquitous Constantly Variable Transmission (CVT), and since that is one of the major driving forces behind concessional scooter licences and the scooter boom in sales – pause for breath – almost no one knows how it works. Let's fix that right here.

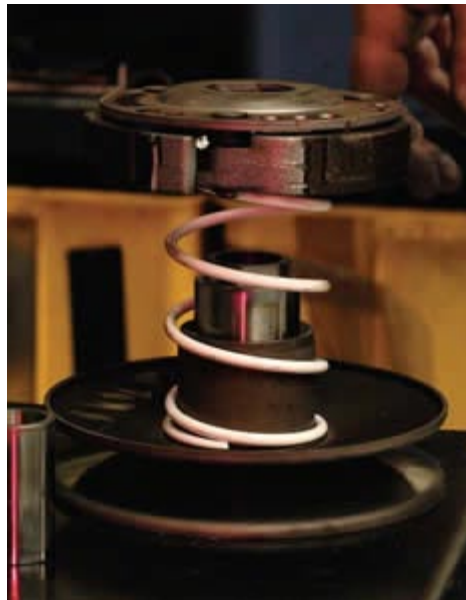


The transmission laid bare. At rest the belt sits between the front pulley halves, while the rear pulley halves (hidden by the concentric clutch) are held together.

Scooter engines, like all automotive engines, need gearboxes to make them more efficient at driving the vehicle. Without a gearbox, a scooter's speed would be completely dependent on the



Inside the variator, you can see three of the rollers and, in the empty spaces, the ramps they have to climb to change gears.



The two rear pulley halves, with the loading spring and the centrifugal clutch before it's all bolted in

Your 10-speed bike had two gears (or chain rings) at the front and five at the back. By operating the gear levers, you shifted the chain between the chain rings, changing the gearing. There were a lot to choose from, but the basic rule was a small gear at the front and a large gear at the back was low gearing, suitable for climbing hills and low speeds (because each pedal stroke caused less rotation at the rear wheel), while a large cog at the front and a small cog at the rear was the highest gear (because each pedal stroke turned the rear wheel more). Moving the chain from cog

to cog required extra, spring loaded chain length to fit the different sized gears. While scooter transmissions run on the basic big cog/little cog premise, there are differences.

There are no separate gears and no extra length to the drive belt to accommodate gearshifts. That is how the transmission works as a Constantly Variable Transmission (CVT) system.

The front and rear cogs of your pushbike have been replaced by a pair of pulleys in your scooter, each pulley made up of two, conical, sliding halves with a fixed length belt running between them. The front pulley is driven by the engine, via gears from the crankshaft. The rear pulley drives the rear wheel, again via gears. In between that and the rear wheel is an automatic clutch (so the engine can idle when the scooter is stopped).

It is the sliding nature of the pulleys that creates the really clever CVT. At rest, the front pulley halves are held open by springs, while the rear pulley halves are held shut. This gives the 'small gear at the front and large gear at the back' effect of the lowest gear on a 10-speed bicycle. As you accelerate, the front pulley halves close together and that forces the rear pulley halves apart. Remember, the belt that runs between the pulleys has a fixed length, so when the front pulley closes up, the belt has to force the rear pulley apart. When the front pulley halves are forced completely together, the rear ones are forced completely apart and then you have the large front cog and small rear cog of a 10-speed bicycle's highest gear.

The clever part is that, as the pulleys move apart and close together, the gearing shifts constantly so that two things happen: you never have to change gears; and you never find yourself in the wrong gear. Brilliant, huh?

So how does the scooter know how to change gear? With another clever little piece of kit called the variator. This is a disc-shaped thingy that is fitted to the same shaft as the front pulley. It has a sloped section and carries a number of weighted rollers in a cage around the disc. As the assembly spins, these rollers react to centrifugal force and try to move outwards. As they do so, the assembly climbs the ramp and forces the front pulley closed, which in turn forces the rear pulley open and thus raises the gearing.

When you roll off the throttle, the centrifugal force is reduced and the springloaded rollers drop back, allowing the front pulley to open slightly, which allows the belt to ride lower within the spring-loaded, sliding halves of the pulley, which in turn allows the rear pulley to close up and lower the gearing.

It sounds complex to describe, but it makes riding a scooter far simpler than the old hand-shift set-up. And that's a good thing. Be happy.

What is

Gearing

Gearing, in this instance, is simply a means of changing the amount the rear wheel turns in relation to the engine's rotation.

The variator

The variator is a disc containing weighted rollers disposed radially in a cage and fixed to the sliding front pulley. As it spins faster, the weights climb ramps, forcing the front pulley halves together, and raising the effective gearing. The variator does not in itself change the gearing – that is fixed by the size of the two pulleys – but it does affect the rate at which the gearing changes. The weight of the rollers may be changed to fine-tune the transmission and is a popular performance modification for scooter owners.

The clutch

The clutch allows the scooter to idle with the engine running by isolating the rear wheel from the transmission. It operates in much the same way as the variator, being of a centrifugal design. As you twist the throttle, the engine increases its speed and the belt drive spins the clutch. As the rotational speed increases, centrifugal force causes the clutch inner to expand, and begin driving the clutch outer, which is connected to the rear wheel.

CVT

Twist and go, baby!

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