Dynamic Performance

Introduction
Dynamic Performance R&D of Nissan Motor Company initiative can be summed up in one aim: to interpret drivers’ input more insightfully than ever before; and to execute those intentions with greater speed and precision than ever before. The ultimate goal is to create distinctively superior driving experiences that bring to life the brand values of Nissan and Infiniti.

The intellectual muscle behind this initiative is a concerted effort across Nissan’s R&D establishment to cultivate an acute awareness of human senses and preferences – to understand very deeply how people perceive every aspect of the car.

The resulting insights are used to tune a growing toolkit of electronic functions that stem from Nissan’s strength in control technologies and CVT (continuously variable transmission).

Advances in electronic functionality give Nissan the opportunity to bring customers a wide spectrum of new value. But that value only takes shape when these innovative functions arrive amazingly attuned to the driver’s commands.

To understand how all these elements come together, consider two recent Nissan Dynamic Performance innovations.
Next generation steering feels like an extension of your body
Where conventional steering conveys input from driver to tires via mechanical links, Nissan’s
next generation steering technology interprets the driver’s intentions electronically, and directs the
tires via electronic signals. You really have to experience it to understand why all-electronic next
generation steering feels more direct and more rooted-in-the-road than any other steering system.
What’s more, it can be tuned to suit the road. Those who try it love it. But all-electronic is a new
concept for drivers to get used to.

“Yeah, everyone starts with the same preconceived ideas,” says Takeshi Kimura of Nissan’s driving
control development team. “They imagine our next generation steering will feel like a video game. So
we give them a blind test, conventional power steering versus the new system. Invariably, they guess
wrong and say that next generation steering offers a more direct and realistic feel of the road. Think
of it like the difference between analogue and digital recordings: you get the music without the
distortion.

“Still, all-electronic steering is a new concept,” Kimura adds. “And people wonder what happens if
you lose electric power. So we show them how the clutch kicks in – mechanically – the instant the
power cuts out. And that’s only the last resort in a series of safeguards that include multiple control
units. There is absolutely no way to lose steering control, no matter what happens with the power
supply. The basic technology is so solid by this point that most new passenger jets today have
steering designed on similar principles.”

But why bother replacing a conventional technology that works just fine?
The answer is like trying to describe the sensation of a kiss to someone who’s never had one. It
sounds weird until you try it. But once you try it, it feels good. Really good.

“We’re really looking forward to seeing how the world’s top auto writers go about describing this,
because it’s been a real challenge for us,” Kimura says. “Just to get the research budget we had to
convince Nissan executives why it would be good. All we could say was that if you explained how
 tofu is made no one would believe it would be good until they tasted it.”

A steering wheel that doesn’t fight back
The benefits of this next generation steering stand right out the moment you hit a stretch of rutted or
washboard road. Amazingly, the steering wheel doesn’t fight back. Instead of vibrating and jumping
around as you expect, its stays still in your hands. The front wheels, meanwhile, track arrow-straight
and respond smartly even to subtle course corrections.

On a smooth expressway what you notice is that fewer small adjustments are needed. The car just
tracks straight. Each little arm movement may be barely discernible, but eliminating hundreds of
them over several hours of driving amounts to a significant stress reduction.
In fact, you can even tune the steering mode with the flick of a button. “Sport” gives the kind of tight, direct response you want on alpine switchbacks, while “Standard” offers a steering feel tuned for everyday driving.

**Not automation, it’s direct sensory connection**
Next generation steering interprets the driver’s input via force applied to the steering wheel, which is fed to the system’s multiple redundant Electronic Control Units (ECUs). The ECUs translate this information into instructions to the steering angle actuator, which causes the front wheels to turn. At the same time, the system transmits information from the road (in effect, what the wheels are feeling) from the steering angle actuator back to the ECUs. The ECUs then filter this information, passing on to the steering wheel only the feedback that the driver needs.

In a very real sense, Nissan’s new system doesn’t just feel more direct – it actually transmits the driver’s input to the wheels faster than mechanical systems. And, likewise, tactile feedback from the road gets to the driver faster. What the driver doesn’t get are the unnecessary vibrations that mechanical systems faithfully transmit, like the juddering from a washboard road.

“There is an important philosophical insight guiding our approach to this work, and it’s characteristic of Nissan,” Kimura said. “Some automakers look at this in terms of ‘automating the steering function.’ But our goal is to link steering so directly to the human senses that it feels like an extension of your body. That’s why we’ve made huge efforts to fine-tune our awareness of very subtle sensations – and it’s paid off.”

**Lateral stability enhanced**
One great feature of the next generation steering is a lateral stability enhancement function that creates a subtle contrast in ‘steering feel’ between the correct line and the wrong course. By helping drivers stay on course along the lane it reduces the need for minor course corrections that lead to fatigue on long drives.

The feeling is so subtle you might not realize it was there – which is how it’s supposed to be: unobtrusive. But Nissan engineers liken it to steering in a u-shaped bobsled run. It's easy to steer
straight along either side of the bottom of the ‘u,’ but as you begin to drift off course, a gradual increase in steering force is required to go further, almost as if the road banked slightly upward on either side. But, again, as it’s subtle there is no barrier to changing lanes.

“It doesn’t direct you down the center of the lane,” Kimura says. “You can track as you choose, along the inside, the outside or the center of the lane. Whatever track you choose, it helps you to follow it straight. But as you begin to stray it gently influences you back on course.

To determine the correct course, the system uses a camera above the windshield that feeds a video signal of the road ahead to the steering system’s processing module, which uses pattern-recognition software to judge where the lane parameters are.

“One key point to grasp is that this is different from lane-keeping technologies that intervene to prevent vehicles from straying over the lines,” Kimura says. “Yes, there is a safety component to this. But the main benefit is straighter, smoother steering. By enhancing the inherent straight-tracking ability of the next generation steering, lateral stability enhancement helps to reduce the need for continual small course corrections that lead to fatigue on a long drive.”
**Active Engine Brake**

Think of it as the CVT equivalent to what you do with a manual gearbox as you enter a tight curve: shift down to decelerate smoothly, then shift back up as you accelerate through the curve’s apex. Active Engine Brake harnesses the advantages of Nissan’s CVT technology to intelligently automate this function in a subtle way. The result is smoother cornering, especially for novice drivers.

Active Engine Brake monitors the car’s steering angle in relation to its speed. So when you come into a curve slightly too fast and apply the brake, the system understands that you need to decelerate. In response, it causes the CVT to gear down, and to continue decelerating until you accelerate again. This allows the driver to focus on steering.

The effect is equivalent to gearing down through a curve with a manual, except much more subtle. Because you don’t get the steep rise in revs that comes when you manually gear down to 2nd, the first time you drive with Active Engine Brake you may need to throw it through a few curves before you appreciate the effect.

![Control mechanism diagram]

Active Engine Brake is also effective in straight-line deceleration, for example slowing down before a red light. Many less-skilled drivers apply the brakes several times between initial slowing and final stop – which can feel like a jerky and inelegant maneuver. With Active Engine Brake everyone performs more smoothly, which reduces driving stress.
“It's deliberately subtle to avoid startling the driver,” said Naoki Miyashita of Nissan's driving control development team. “But the effect is clearly measurable, in terms of reduced wear on the brakes and also in smoother driver performance with both cornering and straight-line deceleration.”

The logical follow-on is clear. If a car makes you feel like a better driver, you are likely to prefer that car. At modest incremental cost, Active Engine Brake delivers tangible value and a distinctively Nissan feeling of dynamic performance.

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