DIRECT ADAPTIVE STEERING™
Applying "by-wire" is the future of steering
Fighter jets, airplanes and ships already have by-wire technology
First used by NASA on the Digital Fly-By-Wire reach program in the early 1970’s
As it became commonplace in aircraft controls, it will also be the future of automotive steering
DIRECT ADAPTIVE STEERING™

- In planes, electronic fly-by-wire systems respond quickly to changing aerodynamics
- Require less maintenance
- Saves costs and weight
- System responds much quicker than human pilot
- What is norm in airplanes today will become common in cars as well
- Similar to other groundbreaking inventions, it may require a shift in thinking
World’s first automotive steering system by-wire technology

- At normal times, the steering wheel clutch remains disengaged
- Steering angle actuator drives the steering rack and controls the tire turning angle
- Steering force actuator generates appropriate steering force feedback to the steering wheel and driver
- Electronic Control Units control the respective motors, with 'mutual monitoring' functions
Safety Overview

- Multiple ECU configuration – similar to aircraft
- Three ECUs constantly monitor each other and the system status with immediately switches to the backup mode should failure occur

DIRECT ADAPTIVE STEERING™

Communication

FAILURE

- clutch: open
- disengage command

FAILURE

- clutch: engaged
Accurate and Improved Response
- Direct digital feed from steering wheel to the steering rack
- No rubber bushes in the system meaning reduction in ‘play’ in the system – no in-built ‘suspension’
**DIRECT ADAPTIVE STEERING™**

Improved Response
- With conventional steering, drivers need to give early input in approaching curves
- With Direct Adaptive Steering, early input is reduced, allowing more intuitive steering

Traditional steering
- When approaching a bend, driver will need to give an "early steer input" (predictive steering) or otherwise, the vehicle will not turn smoothly

With Direct Adaptive Steering™
- By elimination of the inherent steering-vehicle delay (i.e. quicker response), early steer input requirement is reduced, the driver will be able to steer the vehicle more intuitively
**DIRECT ADAPTIVE STEERING™**

**Improved Feel**
- System provides informative and steady feedback force to the steering wheel, with no delay.

**Direct Adaptive Steering**
- Feedback Force
- Tire force
- Tire motion (reaction from road surface)

**Conventional**
- Steering input
- Feedback delay
- Kick-backs
- Tire motion

**Tire force**

**INFINITI**
Additional Benefits (less driving exhaustion)
- Steering correction benchmark result

DIRECT ADAPTIVE STEERING™

Steering correction (deg)
- 88mph (140kmh)
- 125mph (200kmh)

Q50 (with DAS)
Premium average
ACTIVE LANE CONTROL™

- Additional feature to further provide a secure feeling and reduce driver’s fatigue with highway driving
- Driver’s steering correction is significantly reduced

Camera system to detect vehicle’s direction to the lane

Slight compensation of steering reduces the vehicle’s direction to the lane.
ACTIVE LANE CONTROL

Additional Benefits
- Drivers need less steering effort
- Driving overall is less tiring

Individual Changes
- Without system
- With system
DIRECT ADAPTIVE STEERING™

Summary

- Less Tiring
  - Reduced vibration and steering input
  - Easier to keep vehicle in center of lane

- More Precise
  - Where you steer is where you go

- Faster
  - Electronic signal is faster than mechanical

- Personal
  - Driver can choose steering settings based on preferences and conditions