Drive by wire sub-systems in passenger vehicles have been in the news for some time. You might remember Toyota’s recalls for sticking accelerator pedals that seemed to have a mind of their own. There was plenty of news coverage of the various recalls related to the defective accelerator pedal system, creating speculation that a software glitch, or “ghost in the machine” as Popular Mechanics (PM) called it, was responsible for doing things the driver did not intend. In the same article, PM noted that in fact no software issue was found, even after NASA reviewed the source code provided by Toyota.

Wired Magazine reported in October 2012 that Nissan was developing an electronic system that would eliminate the mechanical link between the steering wheel and the actual turning of the wheels. They characterized the system as both a relatively small step from power assisted steering, as well as a logical step towards autonomous vehicles. Nissan did roll the system out in the 2014 Infiniti Q50 Sedan, under the moniker “Direct Adaptive Steering”.

![Infiniti Q50S](infinitinews.com)

**Figure 1** The Infiniti 2014 Q50S includes a system which replaces the direct mechanical connection between the steering wheel and the steering gear with an electronic system that converts driver input into electronic control of the steering. (source: infinitinews.com)

The system includes modes that could be correctly called steer by wire; and Nissan promoted benefits such as eliminating unneeded feedback on rough roads: “Direct Adaptive Steering moderates the need for constant, subtle adjustment, imparting a commanding feeling while helping shield the driver from excessive road vibrations.” As you can see in **Figure 2**, the system includes redundant electronic control modules; it also includes a clutch that, in normal use, disengages the
mechanical link from the steering column to the steering rack.

Figure 2 The Infiniti Direct Adaptive Steering System translates steering input from the driver into electronic signals that are processed and used by the electronics to determine movement of the steering rack. Similarly, actual movement of the wheels and steering gear is processed and used to provide feedback to the driver through the steering wheel. In such a system, input from road vibrations, for example, can be electronically filtered, essentially increasing the signal to noise ratio of what the driver receives as input to control the vehicle. (source: infinitinews.com)

In the current environment, which I term “sue early and sue often”, recalls seem almost inevitable. While General Motors is learning this the hard way, Nissan promptly issued a recall in November 2013 because on some models, the system could fail: “the power steering software may disable the electric steering system and also may delay the engagement of the mechanical steering backup system”. (source: US DoT, NHTSA memo December 13, 2013). The number of affected vehicles for this recall? Twenty three. No, you didn’t read that wrong—23 total vehicles. According to Good Car Bad Car, Q50 sales in the US totaled about 38,000 from introduction in August 2013 through July of this year.

So, does a possible issue in cold climates, affecting 0.06% of vehicles sold, mean these systems are unsafe? In previous posts, I’ve discussed forecasts that autonomous vehicles could be on US roads before 2020, and by that time, just the software part of the autonomous vehicle market could be more than $10 billion. Obviously, to get to these figures, systems even more advanced than steer by wire, throttle by wire, and the like will have to be developed and perfected. Does this seemingly inexorable march to driverless cars pose a risk to us all?

I don’t think we should worry that much. In truth, cars get safer and safer, and electronics not only provide much of the features and conveniences we expect in our cars, they also have enabled most of the important current safety systems, and will do so even more in the future. Perhaps I’m naïve, but I worry less about the electronics and software than I do about sensors. Sensors, you see, are the touch point for the electronics to know what is going on. As such, sensors are also exposed to the harshest environments, and may be subject to drift, damage, interference, or outright failure. And
without good sensor inputs, these systems cannot operate. What do you think the largest risk is in the trend of drive by wire and eventual driverless vehicles?

Also see:

- Automotive automation: Too much, or not enough?
- Toyota's killer firmware: Bad design and its consequences
- Driving revenues: Autonomous cars
- Autonomous cars by 2019?