Electronic control of vehicle systems is evolving very quickly. Starting with today’s electric power steering, and moving into more advanced systems like active front steering and steer-by-wire, electronics in steering enables the kind of control only dreamt of a few years ago. It helps bring safety, performance, comfort and convenience to unheard-of levels. And Delphi is at the forefront, developing electric steering systems for active control to dramatically improve the daily drive.
Sophisticated, reliable electronics are becoming more prevalent in today’s steering systems. The initial desire for electric steering systems was primarily driven by the need for more environmentally friendly, fuel-efficient technology such as our Electric Power Steering System. Delphi has produced more than 2.5 million units of this system, which delivers fuel economy comparable to a manual steering system and eliminates the pump, hoses and hydraulic fluids.

Comfort and convenience have inspired the development of systems like our Quadrasteer™ Four Wheel Steering System, the first large-angle rear steer-by-wire system for full-size trucks and SUVs. This system delivers incredible maneuverability, stability and trailering capabilities previously unseen in this segment, revolutionizing the driving experience for full-size truck and SUV owners.

Today, driven by the strong desire from consumers for improved safety, including reduced possibility of rollover, active control is emerging. Active control uses sophisticated algorithms that function based on constant feedback from sensors in the vehicle. This type of control enables our steering systems to react to the road, the weather or even the state of the driver, augmenting the front or rear roadwheels independent of driver input. Active steering provides enhanced steering response, yaw stability enhancement and handling improvements to the vehicle without impacting the base steering feel. These active systems are smart and quick — often reacting before the driver ever realizes assistance was needed.

Leveraging our experience with electric power steering and Quadrasteer, Delphi is developing a full portfolio of active steering systems that can act alone, be enhanced with unique software or integrated with braking and suspension to positively influence the vehicle dynamics that affect your daily driving life.
“The electrical power assisted steering works well, making parking easy around town, yet firm and direct enough for motorways when the wind is blowing.”

*Sunday Business Post, July 2003*
Delphi’s Automotive News PACE™ award-winning Electric Power Steering was one of the first high-volume, full-assist electric power steering systems on the market. Fully electric and engine-independent, this system utilizes an environmentally friendly, high-efficiency design that eliminates hoses, hydraulic fluid, pumps, belts and pulleys. Fewer parts help make vehicle assembly a snap, helping save manufacturers up to 3.5 minutes per vehicle.

You can tune the system in minutes instead of months using proprietary Delphi software that characterizes vehicle handling requirements.

Electric power steering is an on-demand system which eliminates the continuous parasitic losses of engine power for better performance. It helps improve fuel economy up to 4%, nearly equivalent to that of a manual steering system. It’s also safer, providing power steering to the driver even with the engine off.

Delphi Electric Power Steering showcases proprietary active return-to-center, active damping capability, active torque damping and built-in speed variable effort. The system features flexible tuning and can be applied across the full vehicle range with minimal adaption requirements.

No wonder over 2.5 million Volkswagen and Fiat vehicles are cruising the roads of Europe with Delphi Electric Power Steering on board. No wonder it’s now in America as standard equipment on the 2004 Chevrolet Malibu and Malibu Maxx.

*Premier Automotive Suppliers’ and OEMs’ Contribution to Excellence (PACE).*
"For colossal pickups and SUVs, however, the technology is ideal...no more struggling to dock the Suburban at the Chuck E. Cheese parking lot."

*Ward’s Auto World, September 1, 2002*
Ranging from today’s standard production Quadrasteer™ to fully active and integrated four-wheel steering systems, Delphi’s portfolio continues to grow. These future generations of Quadrasteer help provide increased active safety for trucks, SUVs and even passenger cars.

**Quadrasteer** – Another Automotive News PACE award winner, our four-wheel steering system addresses consumer demand for easier parking and improved handling for full-size trucks and SUVs. It combines conventional hydraulic front-wheel steering with the first large-angle electric rear steer-by-wire system. Quadrasteer is available on select truck and SUV applications and has established high market acceptance with a 99% owner recommendation rate.

**Quadrasteer ES™ (Enhanced Stability)** has all the benefits of Quadrasteer, plus, with input from yaw and lateral acceleration sensors, it actively provides enhanced stability control at or near the handling limit of a vehicle, such as emergency evasive maneuvers.

**Quadrasteer with RSE (Rollover Stability Enhancement)** is a version of Quadrasteer ES that uses advanced Rollover Stability Enhancement algorithms to help significantly reduce potential road-induced rollovers in SUVs and full-size trucks.

**Quadrasteer with Delphi Electronic Stability Control 2.0** is a version of Quadrasteer ES that integrates and elevates the performance of each individual system. It actively helps improve stopping distance on certain split-coefficient surfaces and enhances stability control over the full range of driving conditions.

**Active Rear Steering for Passenger Cars** provides an innovative, affordable system for dynamic handling enhancement and active safety management on passenger vehicles. This combination delivers high value to the end consumer who wants added safety but also desires superior ride and handling characteristics for everyday driving comfort and enjoyment.
Active Front Steering
Steer-By-Wire

Our front steer-by-wire system eliminates any mechanical connection between the driver and the front wheels. Conventional steering elements are replaced by two actuators positioned in the front corners of the vehicle.

The actuators get commands from the control module and turn the front wheels as directed. The system also uses an electric motor to provide simulated road feedback to the steering wheel.

Fewer components help provide increased reliability and packaging flexibility, reduced mass, improved fuel economy, simplified assembly and more interior design options. The elimination of hydraulic fluid yields obvious environmental benefits.

Our rear steer-by-wire system, Quadrasteer™, positions the back wheels based on front-wheel position and vehicle speed. It provides a much tighter turning radius, increases higher-speed stability and enhances trailering capabilities.

Both our front and rear steer-by-wire systems are ready for integration with advanced vehicle control systems.

Delphi’s Active Front Steering (AFS) system delivers leading-edge vehicle stability and variable ratio control with virtually no tradeoffs to base steering performance such as noise, lash, returnability and on-center feel.

AFS helps provide drivers with simplified city driving and parking by reducing the turning required at low speeds so that hand-over-hand parking maneuvers can be accomplished in as little as two-thirds of a turn of the steering wheel.

Delphi AFS then smoothly transitions from a low-speed steering ratio to a high-speed steering ratio, providing a tighter, sportier feel for driving enjoyment and better control on the highway.

AFS accomplishes this by modifying the steering kinematics, or motion, of the vehicle to enhance comfort, safety and control in a manner similar to steer-by-wire. The system electronically influences the steering angle on the wheels, enabling it to be narrower or wider than the driver’s steering wheel angle. Although some may think this is intrusive or controlling, those that have experienced Delphi AFS realize it helps make driving very easy and enjoyable.

AFS is one of the newest technologies in Delphi’s line of Advanced Vehicle Dynamic systems, which help enhance safety and improve vehicle performance, ride and control.

Using Delphi’s Unified Chassis Control (UCC) strategy, these technologies are self-sufficient but integrable with common, modular algorithms and open architecture and interface standards. AFS can be integrated to provide a seamless connection between steering, braking and suspension systems.

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Driver work reduction, basic maneuverability, handling enhancement and improved rollover stability are just some of the vehicle dynamics Delphi’s active steering systems can positively influence.

Our active systems support strong industry movement toward stability enhancement and rollover avoidance. These trends are being bolstered by legislative initiatives for improved safety ratings. For example, our Rollover Stability Enhancement (RSE) algorithm can be used to enhance an active steering system like Quadrasteer ES™ to help significantly reduce the likelihood of rollover. Or, if the vehicle manufacturer seeks additional benefits such as improved stopping distance, then Quadrasteer ES integrated with Delphi Electronic Stability Control 2.0 could be applied to help achieve both objectives.

Whether a single system, a software enhanced system or a system integrated with braking or suspension under Delphi’s Advanced Vehicle Dynamics family of products, we have the flexibility to meet the objective of the vehicle manufacturer.