Design and Performance Simulation of Modern Automobile & Automatic Navigation Control System

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Abstract. This Study Focuses on the Composition, Performance, Application Field and Performance Simulation of Automotive & Automatic Navigation Control System, and Based on the Control Concept of the Specific Scheme, the Design Execution Leader is Used to Study the Redesign of the System Feedback. Finally, the Digital-Analog Simulation System is Applied to Improve the Control System, in Order to Provide a Feasible Reference for the Design and Performance and Improvement of the Modern Automobile Automatic Navigation Control System.

1. Introduction
The modern car automatic navigation control system is called GPS car navigation system. It consists of chip, antenna, processor, memory, display, speaker, button, extended function slot, electronic map, navigation software and so on. In terms of importance, the system, acting as the vehicle hub, should be freely rotatable, high adsorption performance, soundbroadcasted, clear and fast [1]. because the design of the system is mainly due to the improvement of the navigation capability of the navigator, and thus provides system update support for safe driving of the car in terms of receiving capability, road navigation and road obstacle avoidance.

1. Organizational framework of modern car automatic navigation control system
The modern car automatic navigation control system is composed of three sub-units: which is the sensor, control unit and actuator, and each unit is differentiated by the hard and software. Only in this way, the vehicle-mounted mechanical system can cooperates with it to meet the basic operational requirements of the transmission system. As shown in Figure 1:

![Figure 1: Hyundai Auto Navigation Control System](image-url)
The automotive electronic control subsystem cooperates with cables or radio waves to provide an electromechanical integration advantages in information transmission, and to operate freely and interactively in an actual fuel, brake, for the anti-skid suspension system to frequently control the automatic shifting, because the performance of the control system is closely related to the electronic engine control system and the chassis integrated control system, this two jointly or collectively determine the performance of the control system.

2. The Design and Implementation of Modern Car Automatic Navigation Control System

The modern automobile automatic navigation control system device mainly performs the extension design of the above-mentioned organizational framework, that is, it meets the three indexes of the automatic control system such as stability, rapidity and accuracy, and the specific device design is as follows:

(1) The engine control system

The system specifically includes an electronically controlled ignition device (ESA), which cooperates with an electronically controlled gasoline injection (EFI) working electronic ignition system to further optimize the ignition advance adjustment device, which is direct and more correct in the ignition signal. In the simulation performance optimization, the device can store the optimal pre-ignition angle of the engine at various speeds and loads during the electronic control unit test, thereby shortening the calculation time and making the ignition signal control more comfortable. The electronically controlled gasoline injection (EFI), commonly use the “electrospray system”, and its main control principle is that the engine-related parameters are measured by various sensors of the electronic control unit and the computer feedback fuel injection amount breaks the flammability and the condition of the mixed gas is restricted which makes the control performance stronger as well.

Exhaust the Gas Recirculation (EGR) - This system controls the solenoid valve freely by means of computer technology, which is mainly based on the engine speed, valve opening, exhaust/intake flow rate and temperature, between exhaust gas and intake air to construct a green channel of the second cycle [2]. Idle Speed Control (ISC) - This system is an important part of the modern car automatic navigation control system, which intuitively reflects on the performance of automotive technology, especially to ensure the stability of the control system and to maintain a sufficient power, save costs, and control sewage, which is the rational application effect. Specifically as shown in Figure 2:

![Figure 2](image-url)  
**Figure 2**: Engine Control System of the Modern Car Automatic Navigation Control System Subsystem

(2) The chassis control system

The main components of the system include: Electronically controlled automatic transmission (ECT), anti-skid control system, electronically controlled power steering. The subordinates of each device covers the anti-lock braking system (ABS), the electronic stability system (ESP), hydraulic...
torque converter, electronically controlled anti-skid control system (ASR), suspension system [3].

ABS avoids pure slippage of the wheel on the road surface and shortens the braking distance; ESP can avoid the occurrence of “drifting out” and “tail”; the torque converter which has the functions of torque change, shifting and clutching. The ASR is a traction control system that enables drive wheel slip control. The suspension system guarantees ride comfort and handling stability and riding comfort [4].

3. The Simulation Performance Analysis of the Modern Car Automatic Navigation Control System

In the above research of automatic control system, an application based on GPS automatic navigator realizes follow-up control in receiving signals, navigation control, steering, detection and maintenance, braking and locking. The specific reference formula of the navigation control transfer function model is shown in Figure 3:

\[
G(s) = \frac{K \prod_{i=1}^{l-1} (s - z_i)}{\prod_{j=1}^{n-1} (s - p_j)}
\]

Figure 3: Navigation Control Transfer Function Model Reference Formula

Application performance analysis: Stability - The stability of the constant value system is effective in ensuring system stability and adjusting the expected value in the short term. Rapidness—that is, dynamic performance—in the form of transition and its urgency, stabilizes the angle, tracks the target, and changes instantaneously with the target. Accuracy – Accuracy measurement accuracy with steady-state error between steady-state output and reference input is a measure of accuracy [5].

Application area and scope analysis:

The application of the automobile automatic navigation control system in the automotive field is based on the performance simulation as the measurement result, and the application of the corresponding control system is highly exerted in the digital computer performance control, is the degree of automation, and the function of the control system. The field test results show that the proposed DGPS automatic navigation control system, when the tractor travel speed is 0.8 m/s, the maximum error of linear tracking is less than 0.15 m, the average tracking error is less than 0.03 m, the proposed cross-track steering control method has a good applicability of testing the tractors [6]. The system is designed with the help of the parameterized control subsystem of the automatic control device to counter the external interference and return to the normal driving state, and the automatic control performance of the key parameters is extremely high.

4. Conclusion

The design research of modern car automatic navigation control system and the application of related devices are mainly based on ensuring the force required on the steering wheel under various driving conditions to achieve effective control. In the performance improvement of the whole vehicle, the simulation system with the characteristics of steering and response is designed to meet with the requirements of low-speed and high-speed driving control.

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