

The microcomputer is the most powerful component available at this time for application to highly functional and high-precision electronic control systems in automobiles.

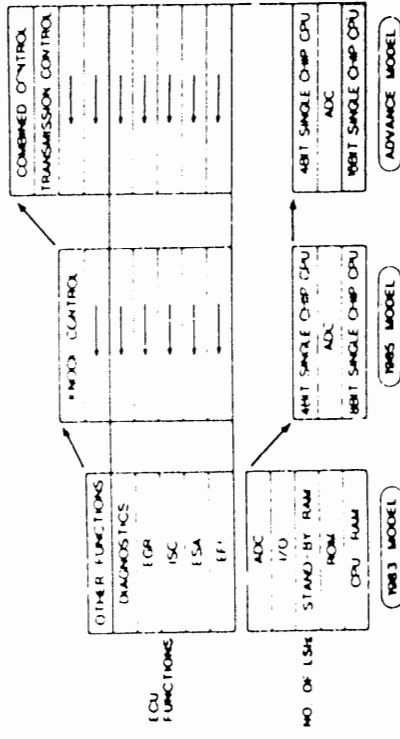
Toyota Motor Corporation recently introduced an 8-bit microcomputer and this has now been followed by the development of a new 16-bit microcomputer to permit major expansion of the functions available in such systems. This is a single-chip VLSI which is flexible and sophisticated, quite suitable for real-time control systems in automobiles. It provides large memory, both ROM and RAM, a powerful instruction set appropriate for use in real-time control, high-speed and intelligent input/output (I/O) functions, and higher speed of data communication functions for intercommunication between microcomputers.

This microcomputer has realized the development of a high-speed and high-precision combined control system centered upon engine and transmission control.

## 2. Introduction

Engine control systems using microcomputers have grown more complex in order to enhance engine performance. The functions of electronic control units (ECU) have also been enhanced in accordance with this trend. (Fig. 1)

As of the 1985 model year, in parallel with the introduction of the knock control system, Toyota Motor Corporation developed a single-chip custom designed 8-bit microcomputer and started its applications. This microcomputer permitted highly functional and high-precision real-time processing, and is now a major part of the all engine control ECUs in Toyota models.



**Fig. 1 Function Growth of Engine Control**

Since that time, there has followed a continuous series of technological developments related to engine control functions, with the purpose of realizing lower emission levels, higher fuel economy and better drivability. A number of new functions have also become necessary for transmission control systems, primarily for the purpose of reducing the shock during gear shifts. A further requirement that has developed over the course of time is for interrelated functions in both engine and transmission control system, in order to achieve further improvement of fuel economy and further smoothness during gear shifts.

In response to these various requirements, a large-scale ECU has been designed in order to unify the engine control system and the transmission control system into a single system. Naturally, the microcomputer which is the heart of the ECU must have higher capabilities and increased flexibility. In fact, these requirements are so complex that the 8-bit microcomputers in current use will soon become inadequate for high-end systems.