Topics

Description language and library for executable specifications of automotive control system

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In automobile safety and environmental preservation, automotive control systems using microcomputers such as EFI and ABS play significant roles. Such software is complicated in structure and becomes expanded in scale year by year, while saving development time with quality maintenance is required. With the aim of elaborating the software quality in the upstream of the development process, we have developed a description language Schetch/M and a library for executable specifications of the automobile control systems.

Schetch/M is a kind of graphical data-flow language. Schetch/M makes it possible to check the behavior of the control system by simulations and produce a C source program automatically when it is used for creating the specifications for the automotive system.

Schetch/M is built on a control system design tool MATLAB/ SIMULINK. **Fig. 1** shows a part of the menu windows of Schetch/M. Schetch/M has the following features in modeling the automotive control system as follows. (1) It describes the data flow by data line, control flow by event line, and function by block. (2) The output data of the functional block is decided according to the time series of input data. (3) The functional block is driven either by the period or the events.

Based on this model, the library of Schetch/M is composed of about 40 kinds of functional blocks made by analyzing and arranging the conventional specifications of automotive control systems. The examples of the functional blocks of the library are shown in **Table 1**.

In the application to the ABS, Schetch/M described the contents of the present specifications except for the parts which depended on the microcomputer hardware. This result proves the following advantages of Schetch/M. (1) The system behavior can be checked by simulations; therefore, the frequency of the experiment using an actual vehicle is reduced, resulting in saving development time. (2) Because the C source program can be generated automatically from the specifications, the programming process becomes unnecessary, and the developed software is of high quality consistent with the actual specifications.

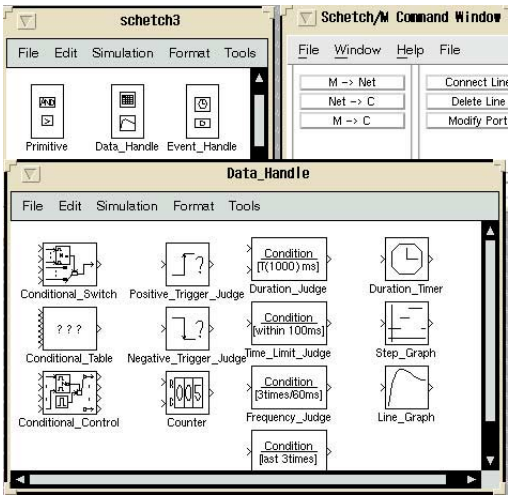

Fig. 1 Menu windows of Schetch / M (part).

Table 1 Functional blocks (part).

Block name	Function
Duration_Judge	Returns 1 if a certain condition is kept in a given period
Duration_Timer	Returns period of time when a given condition is satisfied
Positive_Trigger_Judge	Generates an event when a positive edge is detected
Table_Reference	Returns value according to a given table

Reference

1) Teshima, S., et al. : "EPS program model for embedded real-time system and EFS-based CAE tool Schetch," Trans. Inst. Electronics and Information and Communication Engineers, D-I, Vol. J80-D-I NO. 8 (1997) pp.691-702 (in Japanese)