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ECU Plant Data Writing Sequence Optimization

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With the advancement of vehicle control, the volume of software for electrical components is increasing, and the number of ECUs that write applications and parameters after delivery to the plant are increasing past 20 years. In recent years, the increasing complexity of electrical systems and the increase in the amount of data to be written due to the multifunctionality of ECUs themselves has led to the problem of reducing the takt time of the production line. Operator used to make judgments and assemble the ECU writing sequence. However, due to the addition of constraints such as the requirements for the actual factory equipment configuration, the sequence had to be reviewed at the trial stage before the start of production. Many situations have occurred, and it has become difficult to ensure early quality during production trials.

In this paper, a dependency matrix (Table 1) is defined and a sequence is generated by a tool based on it. To generate optimized path, Critical Path Method (Fig. 2) is adopted to generate the sequence, and the maximum processing time is calculated from the conditions of each state of ECU. Based on that path, it is possible to reduce the total writing time by writing to ECUs with low dependencies using separate communication channels. Figure 3 shows it became possible to shorten the time by about 20% from the conventional write sequence(Fig. 3). By defining the conditions in the Dependency Matrix, it became possible to flexibly respond to changes in process factors, leading to improved reliability of the ECU writing sequence in the electrical equipment process.

Time Taken	Activity	START	A	B	C	D	F	END
0	START	N.A	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
5	A	TRUE	N.A	FALSE	FALSE	FALSE	FALSE	FALSE
6	B	FALSE	TRUE	N.A	FALSE	FALSE	FALSE	FALSE
9	C	FALSE	FALSE	TRUE	N.A	TRUE	FALSE	FALSE
8	D	TRUE	FALSE	FALSE	FALSE	N.A	FALSE	FALSE
2	F	FALSE	FALSE	TRUE	FALSE	FALSE	N.A	FALSE
0	END	FALSE	FALSE	FALSE	TRUE	FALSE	TRUE	N.A

Table 1 Dependency Matrix concept

Fig. 2 Critical Path generation

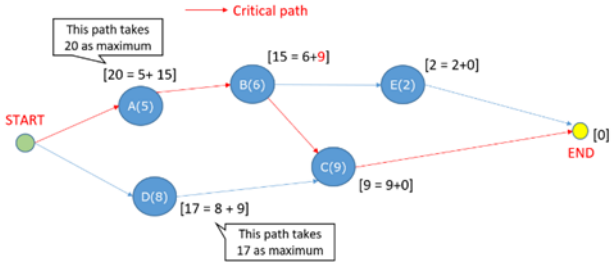
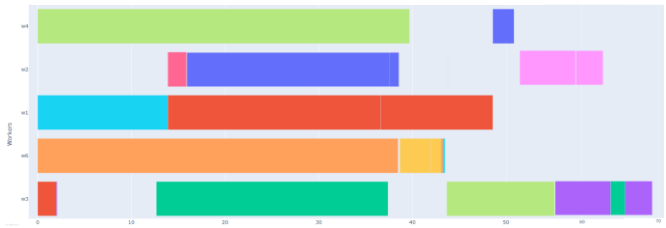


Fig.3 Writing Sequence generation result

Before optimization



After optimization