主　論　文　要　旨

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主論文要旨

The model-based inference is a method which deduces knowledge from a description of system's normal behavior and observed data of the actual behavior. The fault detection based on the model-based inference is called the model-based diagnosis (MBD), a method to find out malfunctioning components of the system.

In the field of artificial intelligence, MBD is called DX. In the field of control theory, Fault Detection and Isolation (FDI) was proposed as MBD. DX can cover unexpected errors. However, DX often requires huge computational complexity.

This dissertation describes three methods to reduce the complexity of DX for diagnosis of logic circuits with discrete dynamics and movable systems with continuous/discrete dynamics. It also describes a hybrid method of DX and FDI for diagnosis of movable systems with continuous dynamics.

First, a diagnostic method based on DX for sequential logic with stuck-at faults is proposed. This method incrementally deduces candidates of faults in sequential logic circuits using their system descriptions and observations of I/O.

Next, an automatic correction method based on DX for combinatorial circuit design with inverter errors is proposed. By incrementally checking if subclauses of system descriptions are included in the specification, the location of incorrect design is automatically detected. This method is tested on ISCAS85 benchmark circuits.

Furthermore, a diagnostic method based on DX for continuous systems is proposed. This method employs two-step mode abstraction. First, continuous dynamics of the diagnostic object is abstracted to a qualitative state transitional model. Then, the model is converted to a logic circuit model. Faults in the movable system are detected by diagnosing the circuit model using an algorithm that employs the Tableau method. The method's effectiveness is shown by applying it to on-board fault diagnosis of an internal combustion engine.

Finally, for continuous systems described by linear differential equations, a generation method of logical fault diagnostic functions based on improved FDI by DX is proposed. This function's arguments are observed physical values and its return value is a set of fault candidates. This method is applied to the electric throttle system of an automobile engine and showed its effectiveness.