

extracts the abnormality factor candidate variables from the time series data at the predetermined time based on the calculated contribution amount and the first rule.

5           The abnormality countermeasure support information providing means provides the countermeasure support information based on the separated and extracted abnormality factor candidate variables, the correlation information, the second rule, and the third rule.

10           According to another aspect, there is provided a computer-readable storage medium storing a program to be executed by a processor of a process monitoring/diagnostic/support apparatus including a memory, comprising: a first program code that causes  
15           the processor to execute processing of collecting time series data of  $n$  ( $n \geq 2$ ) process variables representing measurement results from  $n$  sensors for measuring a quantity of state or a manipulated variable of a target process and storing the time series data in the memory;  
20           a second program code that causes the processor to execute processing of storing classification information representing a result of classifying the  $n$  process variables into  $p$  ( $1 \leq p < n$ ) output variables  $Y$  that are the quantities of states and represent  
25           performance indices,  $L$  ( $1 \leq L < n$ ) input variables  $U$  representing the manipulated variables, and  $m$

( $0 \leq m < n$ ) intermediate variables  $Z$  that are the quantities of states and represent control/monitor values; a third program code that causes the processor to execute processing of defining, from the classification information and the time series data of the  $n$  process variables for a predetermined period, correlation information representing correlation between the  $n$  process variables including the classification result; a fourth program code that causes the processor to execute abnormality detection data defining processing of defining an equation to generate  $q$  ( $1 \leq q \ll n$ ) abnormality detection data less than  $n$  and a determination criterion to determine one of presence/absence and a strength of an abnormality based on the abnormality detection data from the time series data of the  $n$  process variables for the predetermined period; a fifth program code that causes the processor to execute processing of defining a contribution amount of each piece of the time series data of the  $n$  process variables to the abnormality detection data; a sixth program code that causes the processor to execute processing of defining a first rule to extract a predetermined number of top-ranked abnormality factor candidate variables out of abnormality factor candidate variables that are process variables as abnormality factor candidates in an

abnormal state, a second rule to classify the extracted  
abnormality factor candidate variables into the output  
variables Y, the input variables U, and the  
intermediate variables Z based on correlation  
5 information, and a third rule to provide countermeasure  
support information including a message to support a  
countermeasure in the abnormal state based on the  
classification result; a seventh program code that  
causes the processor to execute processing of  
10 generating the abnormality detection data corresponding  
to the time series data at a predetermined time in  
accordance with the stored time series data of the n  
process variables at the predetermined time and a  
definition of the abnormality detection data defining  
15 means and diagnosing the presence/absence of an  
abnormality in the data at the predetermined time based  
on the abnormality detection data; an eighth program  
code that causes the processor to execute processing  
of, when an abnormality exists as a result of the  
20 diagnosis, calculating the contribution amount of the  
time series data at the predetermined time based on a  
definition of the contribution amount and separating  
and extracting the abnormality factor candidate  
variables from the time series data at the  
25 predetermined time based on the calculated contribution  
amount and the first rule; and a ninth program code

that causes the processor to execute processing of  
providing the countermeasure support information based  
on the separated and extracted abnormality factor  
candidate variables, the correlation information, the  
5 second rule, and the third rule.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view showing the basic  
system arrangement of a process  
monitoring/diagnostic/support apparatus according to  
10 the first embodiment;

FIG. 2 is a schematic view showing an example of a  
process variable classification user interface unit;

FIG. 3 is a schematic view showing Example 1 of a  
correlation determination rule;

15 FIG. 4 is a schematic view showing Example 2 of  
the correlation determination rule;

FIG. 5 is a schematic view showing Example 3 of  
the correlation determination rule;

20 FIG. 6 is a schematic view showing an example of a  
process variable correlation defining interface unit;

FIG. 7 is a schematic view showing an abnormality  
factor candidate classification rule;

FIG. 8 is a schematic view showing an example of