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Multivariate data analysis for faster root cause identification in semiconductor industry

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In semiconductor industry, Statistical Process Control (SPC) is a mandatory methodology to keep a high production quality. It has two main objectives: the detection of out-of-controls and the identification of potential root causes in order to correct them. Contrary to the first objective which is generally well covered by the different techniques already developed, the root cause analysis is still often done with a classical approach which is not very efficient in today's complex processes.

Indeed, the classical SPC approach considers that a measurement operation reflects mainly the previous process operation to which it is attached. However, a measurement operation reflects generally, in fact, a whole stack of previous process operations. Therefore, when an out-of-control occurs, the approach currently adopted in semiconductor fabs, which is based on a decision tree associated mainly to the process operation preceding the measurement, is not sufficient. Since the root causes may come from any operation of all the preceding ones, only a multidimensional data analysis can allow to identify them, by considering all the historical data from the previous process steps. By this way, one can identify the factors that have the most influence on the explanation of the out-of-controls.

Among all the existing methods in the literature, PLS-DA proved to be the most appropriate to find in real-time the out-of-control root causes. An application based on industrial data has demonstrated the pertinence of PLS-DA to identify the root causes of out-of-controls even for advanced technologies with a complex process flow.

Keywords

SPC, Root cause analysis, PLS-DA

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