Reducing Fault Detection False Alarm Rate and Improving Productivity using Multivariate Analysis

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In today's advanced semiconductor processes, fault detection is typically implemented by monitoring twenty to fifty parameters, or more. Univariate analysis (UVA) based fault detection methodologies are plagued with high false alarm rates by the very nature of the statistics of fault detection. This paper will discuss the inherent advantages of multivariate analysis (MVA) fault detection methodologies, and show how a 1000:1 ratio in false alarm reduction can be achieved using MVA as compared to UVA techniques. We will focus on the mechanisms of decision theory, and show a direct comparison between multivariate and univariate statistics. This comparison will quickly show the inherent advantage of MVA in false alarm rate reduction. The analytical results will be verified by comparing the frequency of UVA alarms to MVA alarms based on actual production data.

The benefit of MVA in false alarm reduction will be shown to be just one side of the MVA advantage. We will also demonstrate how MVA provides added benefit by reducing the probability of yield loss detected later in the process. When the false alarm rate is reduced, the production rate increases as a result of fewer interruptions due to operator intervention in the process. When the probability of yield loss decreases, yield increases. MVA based fault detection is a simple solution for both productivity improvement and yield enhancement.