Abstract
Semiconductor yield has traditionally been limited by random particle-defect based issues. However, as the feature sizes reduced to 0.18 micron and below, systematic mechanism-limited yield loss began to appear as a substantial component in yield loss. In addition, it is becoming clear that ramping yield would take longer and final yields would not reach historical norms. A key factor for not reaching previously attained yield levels is the interaction between design and manufacturing. Yield losses in the newer processes include functional defects, parametric defects and issues with testing. Each of these sources of yield loss needs to be analyzed and understood by designers and tool developers. In addition, new techniques and methods must be devised to minimize the impact of these yield loss mechanisms.

After an introduction of the issues involved in the first section, the second section covers Design-for-Manufacturing (DFM) techniques to analyze the design content, flag areas of design that could limit yield, and make changes to improve yield. However, once the changes are made it is necessary to quantify their impact so that knowledge about yield contribution of different features can be fed back to design and DFM tools. Test presents an opportunity to close the loop by crafting test patterns to expose the defect prone features during automatic test pattern generation (ATPG) and by analyzing silicon failures through diagnosis to determine the features that are actually causing yield loss and their relative impact. The third section covers design techniques (DFX) to improve testability, debuggability and diagnosability, and DFM and defect aware test generation to both meet product quality and expose yield issues at test. Section four covers the basic concepts and theoretical aspects of debug and diagnosis including algorithmic IC diagnosis, scan chain diagnosis, critical path based techniques and diagnosis of delay defects. The applications of the basic concepts and techniques for silicon debug are covered in section five. Section six covers the application of statistical diagnosis techniques to determine the features that are actually causing yield loss and their relative impact. Finally, in section seven, future trends, challenges and directions are covered.