

Prognostics and Health Monitoring For Improved Qualification

Michael Pecht
Chair Professor and Director
CALCE Prognostics and Health Management Consortium
CALCE Electronic Products and Systems Center
University of Maryland

Electronic devices and products are changing very rapidly, customers have more choices, tremendous price pressure exists on suppliers, and there is pressure to test quickly. However, many of the traditional test and qualification standards are not working. Over the past 10 years, there have been an increasingly large number of products that have passed qualification tests but have failed in the field. The resulting costs of these failures have been in the hundreds of millions of dollars for many companies.

This presentation introduces in-situ system-level reliability assessment, which incorporates a hybrid-data recognition and physics-of-failure based prognostics approach into the data analysis. This prognostics and health management process is used to assess the extent of deviation or degradation of a product from its expected normal operating conditions, and then, based on continuous monitoring, predict the future reliability of the product. By monitoring key control signals and loads, this data is used in conjunction with precursor reasoning algorithms and stress-and-damage models to enable prognostics. This approach is being developed at the CALCE Prognostics and Health Management Consortium for implementation into space, avionics, automotive and computer systems.

Prof Michael Pecht has an MS in Electrical Engineering and an MS and PhD in Engineering Mechanics from the University of Wisconsin at Madison. He is a Professional Engineer, an IEEE Fellow, an ASME Fellow and an IMAPS Fellow. He served as chief editor of the IEEE Transactions on Reliability for eight years and on the advisory board of IEEE Spectrum. He is chief editor for Microelectronics Reliability and an associate editor for the IEEE Transactions on Components and Packaging Technology. He is the founder of CALCE (Center for Advanced Life Cycle Engineering) at the University of Maryland, College Park, where he is also a Chair Professor in Mechanical Engineering. He has written more than twenty books on electronic products development, use and supply chain management and over 400 technical articles. He has been leading a research team in the area of prognostics for the past ten years, and has now formed a new Prognostics and Health Management Consortium at the University of Maryland. He has consulted for over 50 major international electronics companies, providing expertise in strategic planning, design, test, prognostics, IP and risk assessment of electronic products and systems. He was awarded the highest reliability honor, the IEEE Reliability Society's Lifetime Achievement Award in 2008. He has previously received the European Micro and Nano-Reliability Award for outstanding contributions to reliability research, 3M Research Award for electronics packaging, the IEEE Undergraduate Teaching Award, and the IMAPS William D. Ashman Memorial Achievement Award for his contributions in electronics reliability analysis.