products tested by the system is more than 50. The return on investment of the data-driven test system shows that this type of test system is necessary to stay competitive in today's marketplace.

Vector Network Analyzer Test System

More recently, a data-driven test system was designed and implemented for a family of network analyzers. The complexity of instrument testing dictated that the data-driven test system be limited to a product family instead of a product classification. The system is currently testing five products. The new product introduction engineer estimated software generation time saved was approximately 500 engineering hours. More time would have been saved except that additional tests were required. These new tests were developed and added to the system in the data-driven format and are now part of the set of tests to be used by future family products.

In summary, by designing test software to handle large variations within a product classification, the overall manufacturing resources required for the electrical test development process are reduced over an entire product classification. This enormous savings occurs because the continual introduction or reworking of new product test software is eliminated.

Acknowledgments

I would like to thank Claude Ashen for his support and guidance on structured analysis and system design, Steve Waite for his futuristic vision and at times blind faith that the test system would be completed in time to ship his products, and Wes Ponick for his enormous help in putting this project into words.

Authors

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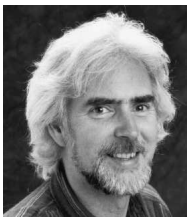
6 Scientific Graphing Calculator

Diana K. Byrne

With HP since 1988, Diana Byrne is an R&D project manager for calculators at the Corvallis Division. She was born in Portland, Oregon and received a BS degree in mathematics from Portland State University in 1982, an MS degree in mathematics from the University of Oregon in 1987, and an MS degree in computer science from the same university in 1988. On her first HP project, she developed software for plotting, graphics, and the EquationWriter for the HP 48SX calculator. She was R&D project manager for the HP 48G/GX calculator software and hardware. She is coauthor of a 1991 HP Journal article on HP 48SX interfaces and applications. Diana has two sons. Her favorite leisure activities are bicycling and reading.

Charles M. Patton



Software scientist Charlie Patton received a BA degree in mathematics and physics from Princeton University in 1972 and MA and PhD degrees in mathematics from the State University of New York in 1974 and 1977. He joined the HP Corvallis Division in 1982 as a software R&D engineer and has contributed to the development of the mathematics ROMs for the HP 75, HP 71B, HP 28C/S, and HP 48S/SX calculators. For the HP 48G/GX calculators, he worked on the RPL system and the 3D graphing routines, and was a general consultant and troubleshooter. He is currently working on several projects in the areas of software research, computer visualization, and symbolic and numeric techniques. He's also coauthoring a calculus textbook that incorporates technology as a teaching tool. He's named an inventor in three patents on operating systems and symbolic computation methods for handheld machines, and is the author or coauthor of technical papers on general relativity, representation theory, handheld computation, and calculus. He is a member of the American Mathematical Society, the American Association for the Advancement of Science, and the Internet Society. His outside interests include birdwatching, native plants, rafting and canoeing, fishing, gardening, Celtic harp, concertina, and calligraphy. A long-time HP telecommuter, he is also involved in remote sensing and internetworking.

David Arnett

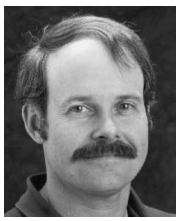
David Arnett is a hardware design engineer at the Corvallis Division and has been with HP since 1991. He designed hardware and was the manufacturing liaison for the HP 48G/GX calculators. Currently, he designs hardware for the HP OmniBook product line. David was born in Cleveland, Ohio and attended Brigham Young University, from which he received a BSEE degree in 1989. He worked on avionics design at General Dynamics and on superconductivity research at Oregon State University before joining HP. He's a member of the IEEE. David is married, has two children, and enjoys music, both as a performer and as a conductor.

Ted W. Beers

Software R&D engineer Ted Beers came to HP's Corvallis Division in 1985 and has contributed to the development of the HP 48S and the HP 28C/S calculators. His work on the HP 48S includes the interactive stack, high-level display management, and user customization. He worked on user memory organization for the HP 28S and performed extensive testing on the HP 28C. For the HP 48G/GX calculators, he was responsible for the user interface elements. His work on a software technique for data and text entry has resulted in a patent, and he is the author or coauthor of three other technical articles, one written while he was in high school. Ted was born in West Lafayette, Indiana and received a BS degree in computer and electrical engineering from Purdue University in 1984. He's married and enjoys hiking with his wife and two beagles. He's also

interested in gardening, house design, home improvement, philosophy, and the environment.

Paul J. McClellan



A software engineer at the Corvallis Division since 1979, Paul McClellan has developed software for several HP calculator families, including the HP 15, HP 71, HP 28 and HP 48. He also implemented and maintained user interface software for OSF/Motif. For the HP 48G/GX calculators, he was responsible for design and implementation of new numerical functionality. He's currently working on software for future products. He is named an inventor in two patents related to calculator development and is a coauthor of several HP Journal articles. He's also a member of the IEEE and the Society for Industrial and Applied Mathematics. Born in Salem, Oregon, Paul received a BS degree in mathematics and physics from the University of Oregon in 1974 and a PhD in statistics from Oregon State University in 1984. He also has a degree in computer science from the National Technological University (1991). He worked at Tektronix before joining HP. He is married and has two sons. His outside interests include mountain climbing, nordic and alpine skiing, and reading.

23 HP-PAC

Johannes Mahn

With HP since 1988, Johannes Mahn is a mechanical design engineer at the Böblingen Manufacturing Operation. He was the project manager responsible for design, development, and testing of the mechanical concept for HP-PAC. Earlier, he contributed to the mechanical design of the HP M1350A intrapartum fetal monitor and worked in process engineering for the electrical test area at the Böblingen printed circuit shop. He is named as a coinventor for two patents related to the HP-PAC chassis and casing. A native of Sindelfingen, Germany, he received a Diplom Ingenieur in precision mechanics from the Esslingen Engineering School in 1988. Johannes is married, has two children, and enjoys mountain biking, handball, and watercoloring.

Jürgen Häberle

Mechanical design engineer Jürgen Häberle was born in Sindelfingen, Germany and attended the University for Applied Science from which he received a Diplom Ingenieur in precision mechanics in 1988. He joined the HP Böblingen Manufacturing Operation the same year and has been responsible for tool engineering, mechanical design, and project management. He worked on the concept and definition of HP-PAC as well as mechanical design and testing. Currently a project manager for HP-PAC, he is named as a coinventor for two patents related to the HP-PAC chassis and casing. Jürgen is married and likes tennis, snowboarding, biking, motorcycling, and traveling.

Siegfried Kopp

A materials engineer at the Mechanical Technology Center of the Böblingen Manufacturing Operation, Siegfried Kopp has been with HP for fifteen years. He worked on materials engineering for the HP-PAC project. A toolmaker before joining HP, he received a diploma as a master toolmaker in 1986. At HP, he has supervised a tool shop and machine center and worked in materials engineering. He is named as a coinventor for three patents related to the HP-PAC chassis and casing and an STE fastening method for sheet metal. Siegfried was born in Stuttgart, Baden-Württemberg, Germany. He and his wife have a daughter and son. He likes the out-of-doors, especially biking and hiking.

Tim Schwegler

Tim Schwegler was born in Aschaffenburg, Bayern, Germany and received a Diplom Ingenieur in precision mechanics from the Fachhochschule Karlsruhe in 1989. He joined HP's Böblingen Manufacturing Operation in 1989, where he was a materials engineer and since 1991 has been a project manager for HP-PAC. His responsibilities have included supplier development, agency contacts, and marketing. Currently, he's with the Entry Systems Division in Fort Collins, Colorado. He is named a coinventor for three patents related to an STE fastening method for sheet metal and the HP-PAC chassis and casing, and for two pending patents on a heat sink attachment method and a fan for a heat sink attachment. Tim is married and has a daughter and son. He likes outdoor activities, including biking, hiking, and skiing.

29 Eye Diagram Analysis

Christopher M. Miller

Chris Miller graduated with a BSEE degree from the University of California at Berkeley in 1975 and with an MSEE degree from the University of California at Los Angeles in 1978. In 1979, he joined the technical staff of Hewlett-Packard Laboratories in Palo Alto, California, where he worked on high-speed silicon bipolar and GaAs integrated circuits. Chris is currently an R&D project manager in the Lightwave Operation located in Santa Rosa, California. In addition to the HP 71501 eye diagram analyzer, some of the products his project teams have previously introduced include the HP 71400 and HP 83810 lightwave signal analyzers and the HP 11982 wide-bandwidth amplified lightwave converter. Born in Merced, California, he is married and has two sons. He enjoys running, weight training, and managing Little League baseball teams.

38 Thermal Management in SFC

Connie Nathan

A product support engineer at the Little Falls Operation of the Analytical Products Group, Connie Nathan was formerly a hardware development engineer on the second-generation HP supercritical fluid chromatography (SFC) system. Her responsibilities included the redesign of a flame ionization detector, the design of the interfaces of the GC oven to the pump module, and the pump module package design. After that project, she continued to work on SFC postrelease enhancements for two years. She is currently developing and implementing analytical product support plans. Born in Rochester, New York, she graduated in 1980 from the Massachusetts Institute of Technology with a BSME degree and in 1981 completed work for an MSME degree from Stanford University. Before joining HP in 1989, she worked in manufacturing and product design for Eastman Kodak and Mohawk Data Sciences. She is a member of the National Society of Black Engineers Alumni Extension and the Forum to Advance Minorities in Engineering. She has also served as a mentor to college women at the University of Delaware.

Barbara A. Hackbarth

Barbara Hackbarth was born in Austin, Minnesota. She studied mechanical engineering at the University of Minnesota, from which she received a BSME degree in 1991. She joined HP the same year. A manufacturing development engineer for the Analytical Products Group in Little Falls, Delaware, her responsibilities have included manufacturing development for the HP 1050 Series and HP 1090 liquid chromatography product lines and bringing the HP G1205A supercritical fluid chromatograph into manufacturing production. She is currently involved with reliability and product improvements for the G1205A. She is a mentor in the University of Delaware women engineers mentoring program. She enjoys outdoor activities, travel, and many sports including tennis, golf, swimming, and skiing. She also plays on HP volleyball, golf, and soccer teams.

43 Linear Vascular Transducers

Matthew G. Mooney

With HP since 1988, Matt Mooney was the project leader for the image quality improvement project described in this issue. A transducer engineer at the Imaging Systems Business Unit, he has worked on thermal design, manufacturing

process development, and acoustic design and product definition for several HP transducers, including the HP 21244, the HP 21246, the HP 21255A, the HP 21255B, and the HP 21258B. He's currently investigating new transducers for advanced ultrasound imaging applications. A native of Burlington, Massachusetts, he attended Worcester Polytechnic Institute (BSME 1988) and later received an MSME degree from Northeastern University (1992). He is a coauthor of one other technical article. Matt is married and has two sons, whom he cares for while his wife attends law school classes. His hobbies include weightlifting, skiing, golf, and making wooden toys.

Martha Grewe Wilson

A transducer development engineer, Martha Wilson joined the Imaging Systems Business Unit in 1989. Her responsibilities have included developing a new backing material and a new interconnect scheme for a family of transducers. She has also worked on designs and fabrication processes for a pediatric transducer and three vascular transducers. She was responsible for the selection and qualification of the material used as the second matching layer for the transducer described in this issue. Martha was born in Minneapolis, Minnesota and received a BS degree in materials science engineering from Rensselaer Polytechnic Institute in 1986 and an MS degree in solid state science from Pennsylvania State University in 1989. She is a member of the American Ceramic Society, a coauthor of two published papers, and author of two papers for internal HP conferences. She's married and has an eight-month-old son. She likes running, swimming, skiing, and playing piano.

52 Driver Redesign

Catherine L. Kilcrease

Project manager Keti Kilcrease works at the HP Information Networks Division. She came to HP in 1985. A California native, she was born in Los Angeles and received a BS degree in biological science from the University of California at Davis in 1980 and an MS degree in computer science from California Polytechnic State University at San Luis Obispo in 1984. She designed a serial printer driver for the MPE/iX operating system on the HP 3000 computer system and enhanced and supported several modules in terminal and serial printer drivers. She was the technical lead engineer for the redesigned terminal and printer driver described in this issue and now manages a team of engineers who are developing processor independent netware on the PA-RISC platform. She is the author or coauthor of two papers on structured analysis and design. Keti is married and has two children. She plays soccer, coaches in a youth soccer league, and enjoys spending time with her sons.

62 Data-Driven Test Systems

Adele S. Landis

Adele Landis joined HP in 1982 and is a software technician at the Network Test Division. Initially, she was a production line technician, working on a variety of network analyzers and accessories. Later, she developed test software for the HP 8720, HP 8753, and HP 8711 network analyzers, as well as for numerous circuits, sweepers, and antenna systems. She designed, developed, and implemented the test systems described in this issue. Adele was born in Arcata, California and has an AA degree from College of the Redwoods. She is studying for a degree in management from Sonoma State University. Her outside interests include running, bicycling, hiking, home improvement, and raising miniature horses.