verum®

Tools for building mathematically verified software

MagLev Stage Software Design for Philips Applied Technologies

Department of Mechatronics

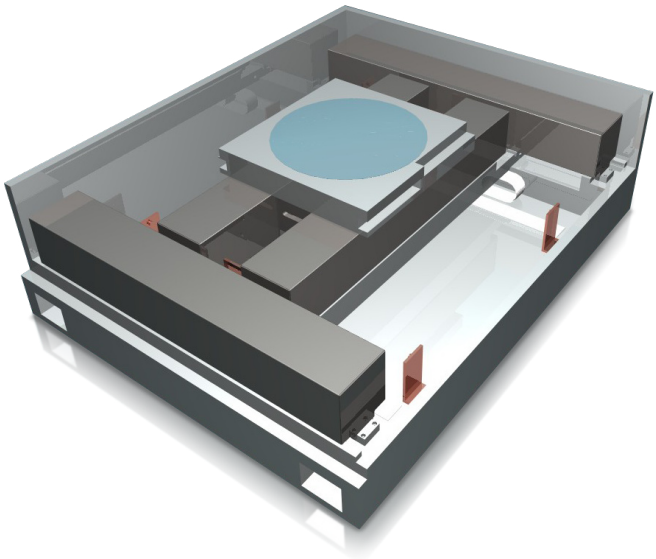
ASD results in a factor 10 reduction in defects

ASD

The simple way to build complex software systems

Philips Applied Technologies is part of Royal Philips Electronics and supports Philips, its partners and suppliers as well as a selected number of non-Philips companies through the application of a range of technologies. Part of its mission is to help customers transform initial ideas into manufacturing solutions.

MagLev Stage



PHILIPS

The Product

One of its latest products is a highly accurate, high performance "stage" known as the MagLev Stage. This is a subsystem designed to be incorporated into a variety of industrial systems that require medium speed, highly accurate positioning, scanning or contouring for applications in a broad range of semiconductor related environments. The MagLev stage uses advanced magnetic levitation servos and achieves micro-metre position accuracy, sub-micron position repeatability and nanometre scanning motion noise. An essential part of the MagLev Stage is the control software embedded in it. This software coordinates the actions of the multi-axis controllers and provides an Application Program Interface (API) to customer developed domain specific application software.

"ASD is the first formal method that is informal enough to be applied in practice."

G.P.M. Haagh Senior Software Architect, Philips Applied Technologies Mechatronics

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The Project

Early in 2004, a "proof of concept" version of the control software was developed to enable the mechanical and electronic sub-systems to be developed and tested. This development took about 10 weeks in order to achieve a level of "good weather" functionality useful for the product development. Although suitable for its purpose as a "proof of concept" prototype, this software was not of the industrial quality levels considered suitable for the final product. Since its initial development, defects emerged at regular intervals, including software crashes and race conditions. By January 2005, more than 20 versions were present in the software configuration management system, each representing a release to fix multiple errors.

In September 2004, it was decided that a new version of the controller software would have to be developed in order to achieve required quality standards. Given the complex nature of the software, Philips Applied Technologies and Verum together applied Analytical Software Design (ASD) in which the complete software design is modelled and model-checked for correctness before implementation starts.

Results and Conclusion

- **After verifying the design mathematically, Verum's ASD techniques enabled 90% of the new code to be generated in C++ automatically from the verified design specifications.**

Philips Applied Technologies concluded:

- **The application of ASD is cost neutral over conventional design methods during the first half of the project lifecycle.**
- **The application of ASD results in a factor 10 reduction in defects found during initial integration testing.**
- **For future projects the application of ASD will result in a predictable completion date.**

See www.verum.com for the full case report.
See www.apptech.philips.com for more information about Philips Applied Technologies Mechatronics and the MagLev Stage