Computation of Background for Photoemission Electron Microscope Image Using FPGA

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The purpose of our development is to design an FPGA based hardware acceleration system that is able to be used for analyzing photoemission electron microscope (PEEM) [1, 2, 3] images or improving their quality. Even though a usual PEEM has an energy filter unit, which is able to eliminate certain disturbing signals, a post processing computation can also be useful to improve the image quality.

Here we propose an FPGA based hardware acceleration system for the computation of a certain image background component. It has uniquely designed hardware modules that perform the computations in parallel, resulting in less calculation time. The system shown here is a prototype which was only used for testing and experimental purposes.

The prototype of the background computer system provided remarkable results and important experiences which will be useful in the design of the final high performance hardware acceleration system. During the development of the prototype we realized that relevant performance enhancement requires a high-end FPGA platform which has the necessary resources to determine the background values in real-time. That device could be used as a built-in or with other words embedded unit with the measuring instrument so it is no longer necessary to use communication protocols between the PC and the hardware. The running time could be easily reduced in the future work, if the system performs the computations in more than two threads of the Shirley modules, which is limited mainly by the applied hardware resources and not by the realization of the method, therefore using a higher performance FPGA, more parallel Shirley modules could be executed simultaneously.

We have also concluded that the removal of Shirley [4] (or analogous e.g. linear) background can enhance the quality of measured images, and our method can also be applied in other fields and different kind of microscopy for different kind of background removals.

References

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