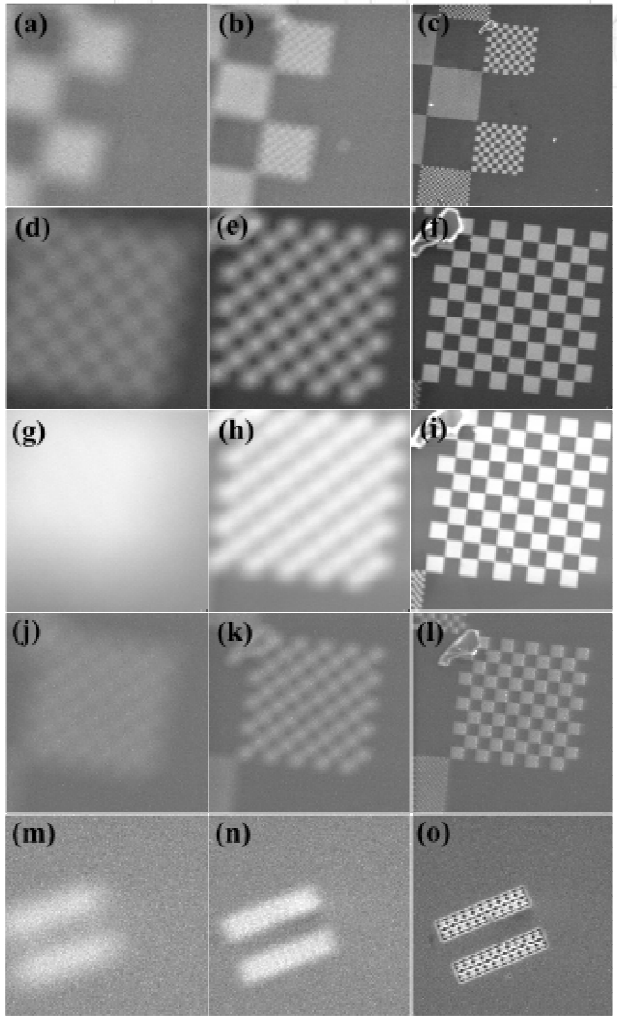
Efficient Autofocusing in Scanning Electron Microscope using Visual Servoing

Research framework

Fast and reliable autofocusing methods are essential for performing automatic nano positioning tasks using a scanning electron microscope (SEM). So far in the literature, various autofocusing algorithms have been proposed utilizing a sharpness measure to compute the best focus. Most of them are based on iterative search approaches, applying the sharpness function over the total range of focus to find an image in-focus. As a result, the process is long. This work investigates alternative approaches based on visual servoing.

Proposed approach

In this work, new, fast and robust visual servoing-based autofocusing method for SEM is studied. Unlike the traditional methods, the developed method performs the focusing by regulating to zero a cost function (primary task). A secondary task is used to improve the primary task: it stops precisely the overall process, when the best focus position is reached. For this work, the normalized variance, a quadratic cost and the gradient of the sharpness score with respect to distance have been selected as sharpness score, primary task and secondary task, respectively. Obtained experimental results prove the fastness of the developed method over existing search-based approaches and its precision in finding the best focus. The proposed autofocusing approach has also been validated at different experimental conditions and the obtained results prove the robustness of the method.



Screenshots of robustness tests of the autofocusing process in different conditions

Major article: Naresh Marturi, Brahim Tamadazte, Sounkalo Dembélé and Nadine Piat. Visual servoing-based approach for efficient autofocusing in scanning electron microscope, IEEE IROS 2013, Tokyo, Japan, pp 2677-2682.

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