Subject: Re: Image astigmatism
Posted by on Thu, 27 Sep 2012 15:40:17 GMT
View Forum Message <> Reply to Message

Den torsdagen den 27:e september 2012 kl. 16:25:35 UTC+2 skrev Helder:
> On Thursday, September 27, 2012 11:42:37 AM UTC+2, Mats Löfdahl wrote:
>
>> Den onsdagen den 26:e september 2012 kl. 16:32:26 UTC+2 skrev Helder:
>
>>
>
>>> Hi,
>
>>
>
>>>
>
>>
>
>>> I was wondering if anybody has tried evaluating the astigmatism of an image, or given two images tell which one is better.
>
>>
>
>>>
>
>>
>
>>> Or does anybody know any good method/reference for doing this?
>
>>
>
>>
>
>>
>
>>
>
>> I think more information is needed.
>
>>
>
>>
>
>>
>
>>
>
>> For example: What is the (kind of) object being imaged? Do you know anything about the optical setup? Might there be a significant amount of other optical aberrations that have to be taken into account?
>

>
>
> Hi,
>
> thank you for your interest. I'm dealing with very different type of setups as compared to 99% of the user group. And most of all I think this type of question is sort of off-topic and would rather fit in a image processing/analysis group. However, I'm interested in the IDL implementation.
>
> I'll try to answer your question. I'm dealing with an electron microscope (EM) and not the standard transmission EM. When you focus on an astigmatic image you will most likely see round objects, however if you go out-of-focus the majority will be elongated along a line l+. For the opposite focusing conditions (under- or over-focus) the objects will be elongated along a line l- perpendicular to l+. The idea would be to acquire two images at under- and over- focus, compare them and evaluate the astigmatism axis orientation and drive the stigmators consequently to correct for this.
>
> That said, I'm thinking of two solutions:
>
> 1) some blob analysis, fitting ellipses and evaluating the axis of these for both images.
>
> 2) evaluating the focus along two axis (x and y) for a focus series. Extract from that the best focus for x and y.
>
>
>
> Well the problem with the two points above are:
>
> p1) Not always images have blobs... images might only have lines.
>
> p2) I have not yet implemented strong focus analysis functions. So far the first idea would be something like total(deriv(MyImage),1) and total(deriv(MyImage),2).
>
>
>
> For these type of microscopes there is no well defined PSF that I can use (I do have a theoretical one, but it does not contain sources of astigmatism).
>
>
>
> I hope things are a bit clearer. At the end, I would really be happy also if I just get appropriate literature references. Hopefully I'll be able to do the rest!

Hmmm... OK, if you had the situation you describe with an ordinary incoherent imaging setup, and you were able to calculate the PSF from a model of the optical setup, including the optical aberrations, I'd point you toward a technique called Phase Diversity, which can be used for estimating unknown aberrations from image data. It is a special case of multi-frame blind deconvolution where you know that the images differ only in focus.

But I don't know enough about EMs to say if this has any relevance to your situation. And anyway you say you can't calculate a PSF that takes the aberrations into account.

So let's think about the option you mention. If you had point-like sources or circularly symmetrical objects in the image, you could analyze the elongation and try to minimize it by making objects as round as possible. And blobs would work if you have many and you can assume their shapes are isotropic on average. Perhaps this idea can work even if you do not have blobs, as long as the assumption of isotropy is still valid. Then the power spectrum would drop faster in the direction of elongation in the image plane. So you might be able to follow a procedure similar to the one you outline, but evaluate the ellipticity of some relevant contours of the power spectrum instead.
