Appendix to "Pattern imaging of primary and secondary electrodynamic instabilities"

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Journal of Fluid Mechanics, vol. 549 (2006), pp. 61–69

Image Processing Stages

The original image [figure 2(a)] has some noise. Much of it is due to the interlacing method of acquisition of our analog camera and is especially apparent where there are large gradients of luminous intensity; i.e., near the edges. This noise is eliminated convolving the image with an appropriate 3×3 mask (Russ 1999), which is equivalent to averaging the two images constructed by linear interpolation from the odd and even lines of the original image. In order to eliminate false edges that lie outside the circular zone of interest, we homogenize the value of pixels outside it. This is easily accomplished by setting an intensity threshold over some typical value, since the outer zone is much darker than the central zone. The remaining noise in the resulting image is filtered with the aid of the *SUSAN* smoothing filter [figure 2(b)], from Smallest Univalue Segment Assimilating Nucleus (Smith & Brady 1997). The advantage over more traditional smoothing, as Gaussian or median averaging, is that the noise is filtered without much affecting the edge information.

Once the original image has been smoothed, we apply the *SUSAN* edge-detection filter (Smith & Brady 1997), whose response to each pixel of the original image is intense (white) only in the vicinity of an edge, in the same way as gradient maps; unlike the more traditional derivative-based methods, this integral method behaves very well in the presence of noise. In fact, it can be used without a previous smoothing step, but the previous smoothing stage allows us to increase the sensitivity of the edge detector (diminish its threshold) without detecting noisy, false edges. The *SUSAN* intensity map is shown in figure 2(c). Compared to more traditional edge detectors, the *SUSAN* edge filter is faster and more reliable (Smith & Brady 1997).

It is also necessary to thin the edges, i.e., select the pixels that locally have maximum gradient, in order to adjust N to the cell edges. To this end, we select only the pixels that have maximum *SUSAN* intensity in the direction perpendicular to the edge, taking as neighborhood a 3×3 mask. A simple linking method of pixels, based on vicinity and approximate direction of edges, allows discarding spurious edge points, as isolated pixels, usually originated by noise [figure2(d)]. For each series of experiments, the smoothing and edge-detection thresholds and the lighting are conveniently adjusted.