Deconvolution of time series. Huber has described a class of projection pursuit procedures wherein the segments of length d from a univariate time series are treated as the basic d-dimensional observations. Projections which give rise to least normal univariate distributions are candidates for the desired filter or inverse filter to be applied to the time series. While considerable success is claimed for such procedures, their rationale seems to depend in part on supposing that the deconvolved series should be an i.i.d. sequence. In many geophysical problems the deconvolved series is expected to look like a step function corresponding to stratigraphy. This suggests that the projection index should pay some attention to the time order of the deconvolved series. For example, one might consider an index based on the scaled total variation of the deconvolved series.

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As always, it is a pleasure to see the carefully thought through and neatly organized result of Huberizing a field.

I shall confine my detailed comments to Section 19, where the $x_{p,t}$ are essentially the column sums of a Buys-Ballot table (e.g. Whittaker and Robinson, 1924).

This approach was once more conventional than the periodogram (not then yet invented). We can improve its behavior somewhat by replacing equally weighted sums, of X_{t+kp} over p, by windowed sums, where the (data) window tends finitely to zero at the nearest points which would have appeared in the sum if their values had been observable, but which were not observed.

The difficulty with harmonics and subharmonics can be minimized by beginning with the largest Fourier amplitude $|c(p)|^2$, which will also be better calculated with a data window (and, further, if more refined assessment of periods is desired, padded rather extensively with zeroes), and then using Buys-Ballot technique to identify—and then subtract—a general periodic constituent whose period is sufficiently close to the Fourier-selected period. A new set of Fourier amplitudes can then be found (cheaply by an FFT), and the cycle repeated.

Notice that

$$\sum (1/m^2)\cos 2\pi(2^{-m}f_0)t$$

shows that we cannot hope, whatever our approach, to always avoid selecting a harmonic of a frequency also present. So we must be prepared to also have a revision process, in which, once we have a good finite sum of periodic terms, we look for harmonic relations among their periods and corresponding reductions of the number of periodic terms. This is needed for the approach suggested above, as well as for any other approach.