
Subject: Re: Digital filter in IDL

Posted by [peter](#) on Fri, 01 Dec 1995 08:00:00 GMT

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Meili Zhong (yafeng@leland.Stanford.EDU) wrote:

: Does anyone know if there is a butterworth filter in IDL?

: There is a filter called `digital_filter` in IDL. It is supposed not
: to cause phase shift. But when I implemented this digital filter
: in to my data, it does cause phase shift. Anybody tried this
: routine?

Digital_filter (the routine) designs FIR filters. Such filters have linear phase shifts, which may be forced exactly to zero by judicious discarding of output points. This follows from the equivalence of time delay and linear phase shift.

For example, if the filter has 9 taps, then it will cause a delay of 4 samples (think what happens when a delta function enters the filter). This will show up as 4×360 degrees of phase shift across the spectrum. If you discard the first 4 points output by the filter, you'll find that the phase shift is now zero.

Butterworth filters, and their digital equivalents, are IIR filters, and as such have non-linear phase response, which cannot be corrected (exactly) by discarding samples. A useful trick is to pass your data through such filters once forwards, then again backwards, to cancel out the non-linearities. The major advantage of IIR filters is in reducing the number of computations required to achieve a certain sharpness of transition, so unless you are doing real-time filtering, the FIR filter produced by `digital_filter` should do the trick.

Peter

P.S. Have a look at Oppenheim and Schafer "Digital Signal Processing" or "Signals and Systems" to learn more.

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