Using the Loop8.xls Workbook.

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This workbook is not intended to replace Loop7.xls, but rather, is a slimmed down version with fewer charts which is aimed at finding the complete response parameters for a particular FBV instrument by means of computations from its component values.

How accurate do I need to be? If you are simply wanting to register your instrument on an online seismic network, a few percent is fine. However, if you are counting on the accuracy of your measurements, you may want to know their responses more precisely.

On the Control worksheet you can enter the nominal values of the components in the yellow cells or, when available, their measured values. For resistors with 1% tolerances, using their nominal values should be fine unless you are trying for the best precision. Some of the other components, identified by the shaded yellow cells have minimal effect on the results and even 10% errors for those will be hard to see in the instrument response.

However, a few components must be measured in order to get accurate results. The capacitors, Cd and Ci have 5-10% tolerance as purchased, and directly affect the response. The mass values, M0 and M1, and the coil constant, Gn, should be measured, as they may vary from instrument to instrument, although M1 may be estimated without hurting the results too much. Most components in the feedback branches and the output amplifiers have a direct effect on the response, though some may only affect the response at higher frequencies which are outside the useful instrument range. Components in the forward 'A' part of the loop are less important, with their only significant effect being on the upper corner frequency of the instrument response or, if significantly different from the reference design, on the tendency of the feedback loop to oscillate.

Loop8 attempts to take into account all the factors which have even a minor effect on the response. One of these is the 1% loading effect of the A/D channels' 100k input resistance on the 1k resistances of the instrument outputs. Enter values appropriate for your digitizer.

Two mass values are now used in the computations. One, M_0, as before, is the weight of the mounted boom, when weighed at the center of the coil, while M_1 is related to the rotational moment of inertia of the boom about the pivot, and represents the mass value, which, if located at the coil's distance from the pivot, would match the actual rotational moment of inertia of the boom. It will always be larger than M_0.

All values are entered on the 'Control' sheet, in yellow cells. Where component values appear anywhere else in the workbook, they will always track the Control sheet values.

The mathematical expression for the gain-crossover frequency will be quite complicated, and rather than attempting to solve for it directly, the worksheet uses Excel's 'Goal Seek' tool to iteratively search for the frequency which makes the loop gain exactly 1, its value by definition. Goal Seek is executed automatically whenever any values are changed in 'Control'. As a result, the Gain-Crossover gain value in the 'GC Gain' cell should always remain at 1.000.