The Graphical X-form Editor

The graphical x-form editor (GXE) is an easy-to-use, WYSIWYG, graphical user interface for the creation and modification of x-forms. It is user-friendly, with ample prompts and warnings guiding the user through the design of a new x-form or the modification of an existing one.

Before GXE, an x-form window could only be designed by hand-editing its parameters-file (known as its .par file). The .par file contains the code specifying the position of each metawidget within the window, as well as the labels and variables necessary for the proper functioning of the window, and the programs to be invoked as a result of the choices selected by the end user of the x-form. With GXE, a .par file is automatically created (or modified) when the user does a "Save" during a GXE editing session.

Previously, .par files were tedious to create and maintain, primarily because of the relative screen geometry involved. The GXE has been designed to alleviate this problem, making the task of designing an x-form quick and easy. With GXE, the designer of an x-form places the desired metawidgets within the GXE "drawing area", where they can also be moved around at anytime. This "drawing area" directly represents what the actual x-form will look like, so there is never any guesswork involved.

In addition to simplifying the x-form layout, the GXE also helps make it possible to design an error-free x-form on the first try. For every metawidget created (or modified), a dialog box is displayed which has prompts for the exact labels and other parameters needed for the proper creation of that specific metawidget. Instant feedback is provided to the user if an entered parameter is invalid, or if insufficient data has been entered.

Some of the features within the GXE are:

- a palette of available metawidgets from which to choose
- a drawing area on which to place metawidgets and show their spatial relationships with respect to one another in the x-form
- pull-down menus for easy file creation, editing, etc.
- dialog boxes that prompt the user to input the appropriate information required for each metawidget, such as variable names, etc.
- the ability to select previously drawn metawidgets so that they can be moved and reconfigured

GXE has three modes of use: a design mode, in which metawidgets are chosen and configured, an edit mode, in which metawidgets can be reconfigured, added, or deleted, and a test mode, in which the newly created or edited x-form is run through the x-form program.

There are well over 100 x-forms used by the Pegasus Session Manager (PSM), and these need editing whenever the capabilities of existing instruments are modified. New instrumentation also requires the creation of many new x-forms. Maintaining and creating this huge number of x-forms was, and would be, an overwhelming task without the time-saving, user-friendliness of the GXE. With GXE, astronomers, engineers, and anyone designing an x-form, even new users, now have the ability to easily create usable x-forms in a short amount of time.

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Interferometric Testing of Optics

A Phase Shift Technology interferometer has recently been set up and demonstrated as a new and versatile tool in the testing of the quality of large optics. This particular interferometer is of the phase shifting type using a modified Shack's cube in a Fizeau configuration with a high quality wavefront reference surface that provides the necessary reference beam yet allows for very good wavefront quality exit beam. Over an f/2 beam this interferometer has an accuracy of 1/30th wave or better.

The interferometer as a whole consists of the laser head, which contains the stabilized HeNe laser, the Shack's cube, telecentric and alignment lenses, spatial filters and the CCD camera. The controller unit allows control over the stability and intensity of the laser and is an interface between the laser head, the monitor, the video digitizer and controller interface boards in the computer. The software is menu driven and aids in the acquisition and analysis of interferometric data.

Setting up the interferometer and test optic is straightforward but in practice may not be easily accomplished. The internal reference beam and the return beam from the test optic must be allowed to focus and create and interference pattern on the CCD. Any intermediate optics must be tested before the optic of interest so that their contribution of errors in the interference wavefront can be subtracted out.

The use of computers in measurement systems has helped bring about phase shifting interferometry (PSI) not because it is a specific optical setup but rather a method of analysis and data collection. Where static interferometry falls short is in the need to collect data only along fringe centers which causes a trade-off between the number of data points and precision. Most interpolating data analysis programs require data to be taken on a regulated grid, and this is where PSI can surpass static interferometry. PSI collects a set of interferograms while a time-varying phase shift is created in a known manner and direction between the reference wavefront and the test wavefront in the interferometer.

In the Fizeau configuration, the phase shift is accomplished by translating the transmissive reference objective with a piezoelectric transducer and an externally applied voltage. The wavefront phase is found in the variations in the intensity of the recorded interferograms, and a point-by-point calculation can recover the phase map recorded on the entire CCD. This method of analysis eliminates the need to locate fringe centers and acquire additional information to determine the wavefront polarity.

In addition to higher precision and wavefront polarity determination, there are other advantages of PSI. Mapping distortions of the wavefront and the test surface are eliminated because the solid state detector array ensures the geometric precision of the sampling positions. This is important when averaging wavefronts to reduce the effects of air turbulence and vibration. Aperture determination is easily found due to the fringe modulation of the interference pattern during phase shifting where points within the aperture will be modulated while points outside will not deviate from an average intensity. The phase map calculated from each point on the detector eliminates problems with intensity variations across the pupil. Because a detector array is used, the phase detection algorithm is