We report on the development of a new image processing software system SPIDER (System for Processing of Image Data in Electron Microscopy and Microanalysis). The need for a user-oriented software system for electron image processing has been previously documented [1]. These systems here in common that they allow users with a minimum amount of computer experience to define complex operations on images.

SPIDER was designed for the use of image processing specialists (e.g., from the Materials Research Corp.) and for multi-user, multi-tasking environment. Image enhancement of large images (e.g., box correlation and box mapping) and the use of structural imaging microscopy (Fourier operations, 3D reconstruction) had to be accommodated. Characteristic for the electron microscopy application is the need to process series of images, resulting in a different use of the computer memory. This makes the use of direct access magnetic tape rememberance mandatory. SPIDER makes it possible to record all the images of a series on one tape cartridge.

Images are read and transferred to the magnetic tape in a form which allows direct editing also of data which is not directly relevant to the image itself. This tape contains all the electronic data which is retained at the end of each run. These images can be edited to produce either printed or display output. No image is lost at any stage.

SPIDER consists of a main task DRIVER and a set of co-tasks (see Fig. 1). The user starts a session by executing DRIVER, and specifies the data libraries it wishes to use.

Fig. 2 shows a schematic diagram of the SPIDER system. As a result of the co-task processing, the user may use FORTRAN-like 30 loops in his batch or procedure code. The main procedure code (e.g., P1000, P2000, etc.) is not visible to the user.

Fig. 2 shows a schematic diagram of the SPIDER system. As a result of the co-task processing, the user may use FORTRAN-like 30 loops in his batch or procedure code. Here we see how a single task (that is to say, a task which is not to be broken down into subtasks) is performed. The steps involved are:

1. Selecting the data to be processed. The user specifies the content of the data that is to be processed.
2. Preparing the data for processing. The data is prepared for processing by adjusting the parameters.
3. Processing the data. The data is processed using the specified parameters.
4. Storing the processed data. The processed data is stored in memory.

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REFERENCES
[1] An extensive system for 3-d reconstruction has been developed by R. A. Brook, L. A. Adair and co-workers at the NBC in Cambridge, England.


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Fig. 1 (top) schematic diagram showing the organization of the SPIDER system.

Fig. 2 (right) example of a procedure command sequence ALL and the use of subroutines. The sequence of co-tasks is designed to align two images defined by the,...