ADVENTURE_Visual

Parallel visualization

Version: β – 0.2

User Manual

January 13, 2001

ADVENTURE Project

Contents

1. Outline

The “Client-Server”-type system is designed to solve large-scale problems (10^7~10^8 degree-of-freedom) with interactive visualization in the PC Cluster environment. “Server” is able to run on parallel-connected personal computers, to read the analysis results, and to visualize the information. The USER can obtain selected 3-dimensional visualized results in a “Client”-type window (including GUI). Basic packages of visualization functions coupled with ADVENTURE_Solid module are promoted in the current version.

2. Operational Environment

- *Operating System*
  Unix, Linux, FreeBSD, etc.

- *XWindow System* (including *XFree86*)

- *Necessary Hardware*
  Server module: *PC Cluster*
  Client module: graphic card, which can support *OpenGL* graphics library

- *Compiler and Development Tools*
  g++ (*gcc* Ver. 2.95.1, or *gcc* Ver. 2.95.3)
  GNU make

- *Necessary Libraries*
  Graphics Library : *OpenGL (or Mesa), Motif (LessTif)*
  The following web sites can be used for reference:
  Mesa : http://www.mesa3d.org/
  LessTif : http://www.lesstif.org/

  ADVENTURE_IO Library
  Refer to the documentation for the ADVENTURE_IO module.

3. Outline of Processing

The present system, including GUI, consists of the Client module and the Server module. The system modules are shown in Fig. 3-1. The Server module is controlled from the Client module, which distributes calculation jobs between the numbers of Master-Slave-type hosts and performs parallel processing of decomposed domain data. The Slave process is in charge of the each hierarchical decomposed domain. The number of Slave processes is the same as the number of hierarchical decomposed domains.

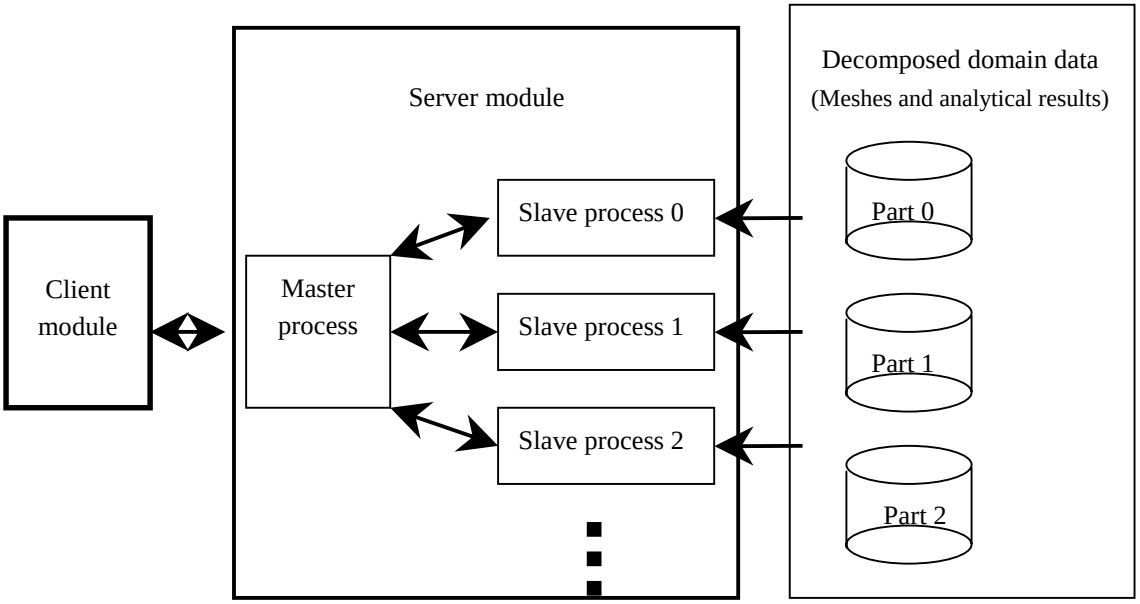

Fig. 3-1. Structure of Modules

Each Slave process of the Server module inputs and calculates the corresponded part of decomposed domain data to obtain visualization (as shown in Fig. 3-1). The information necessary for visualization prepares by each Slave processes, merges in the Master process, and the results are forwarded to the Client module. The Client module receives the visualized information transmitted by a computer network from the Server module. The USER can obtain the necessary runtime visualized information manipulating GUI on the Client module graphics display.

4. Installation Procedure

4.1. File Extraction from Archive

The necessary data are contained in **`AdvVisual-0.2b.tar.gz`** archive. The directories described in Chapter 4.2 will be created after achieve decompression.

4.2. Structure of Directories

After decompressing the **`AdvVisual-0.2b.tar.gz`** archive file, the directory **`AdvVisual-0.2`** will be created. The contents of **`AdvVisual-0.2`** are shown in Table 4.1.

Table 4.1. Contents of Directories

Subdirectory Name	*Contents*
`client`	Source files for Client module
`server`	Source files for Server module
`doc`	Documents (including User Manual)
`examples`	Sample data

4.3. Compilation Method

1. Compilation of Server Module

(1). Install the ADVENTURE_IO module according to its User Manual.
(2). Go to the top directory and execute the following commands:

```
$ cd server
$ ./configure --with-advio=< Path to ADVENTURE_IO directory >
$ make
```

After this procedure, the executable file **`advvis_server`** will be created in the directory **`server`**.

2. Compilation of Client Module

(1). Go to the top directory and execute the following command:

$ cd client

(2). Open **`Makefile`** by an editor and create the following macros:

`INCDIR:` Path to the **`include`** directory used by *Motif* and *OpenGL*
LIBDIR: Path to the **`library`** directory used by *Motif* and *OpenGL*
LIBS: `library` file used by *Motif* and *OpenGL*

(3). Execute the **`make`** command:

```
$ make
```

The executable file **`advvis`** will be created in the directory **`client`**.

5. Program Execution

5.1. Setup of Server Module Environment

In order to execute the Server module, the Hosts of the Local Area Network (LAN) should be created. The hosts, created for use in LAN by the Server module, and the executable files of the Server module, should be registered. The Server module environment is setup in the SYS (system) file (ASCII file with extension **`.sys`**) **`adv-visual.sys`** that should be created by any available editor in the directory, where the Client module will be executed. The SYS file data are input and read only once when the Client module is executed.
The method of the SYS file input is shown below:

1. Input the communication port number of the Server module in the first line.
2. Input the communication port number between the Client module and the Server module in the second line.
3. Input the number of registered hosts in the third line.
4. Input by groups: the hostname and the path to the Server module (path to the installed Server module).

Fig. 5-1 demonstrates an example of the SYS file input. Here, the communication port number between Client and Master is 11111; the communication port number between Master and Slave is 33333; the Server modules are installed in six hosts: **`vt10`**, **`deb11`**, **`deb12`**, **`deb13`**, **`deb14`**, **`deb15`**, and the absolute path to the Server module is specified for each host. The SYS file should be renewed if a new host is added.

```
11111
33333
6
vt10
/home0/AdvVisual-0.2/bin/server/advvis_server
deb11
/home1/AdvVisual-0.2/bin/server/advvis_server
deb12
/home2/AdvVisual-0.2/bin/server/advvis_server
deb13
/home3/AdvVisual-0.2/bin/server/advvis_server
deb14
/home4/AdvVisual-0.2/bin/server/advvis_server
deb15
/home5/AdvVisual-0.2/bin/server/advvis_server
```

Fig. 5-1. Example of SYS File Input

5.2. Setup of Data Set for Analysis

The path to analysis data files used for visualization should be input (setup). Fig. 5-2 shows an input example (the INP file). The first line of the INP file contains the number of “Parts” of the decomposed domain data. This number is followed by a number of sets of paths contained the analytical model filename and the analytical result filename. Here, the analytical model filename of “Part 0” is followed by the analytical result filename of “Part 0”; the analytical model filename of “Part 1” is followed by the analytical result filename of “Part 1” etc. The files of analytical model and results are read from the Server module (Slave process). The path to each file used by the Server module should be set up (input) (the absolute path or the path from each host's home directory).

```
5
AdvVisual-0.2/examples/test/model/advhddm_in_0.adv
AdvVisual-0.2/examples/test/result/advhddm_out_0.adv
AdvVisual-0.2/examples/test/model/advhddm_in_1.adv
AdvVisual-0.2/examples/test/result/advhddm_out_1.adv
AdvVisual-0.2/examples/test/model/advhddm_in_2.adv
AdvVisual-0.2/examples/test/result/advhddm_out_2.adv
AdvVisual-0.2/examples/test/model/advhddm_in_3.adv
AdvVisual-0.2/examples/test/result/advhddm_out_3.adv
AdvVisual-0.2/examples/test/model/advhddm_in_4.adv
AdvVisual-0.2/examples/test/result/advhddm_out_4.adv
```

Fig. 5-2. Example of INP File Input

6. Input of Data Set for Analysis

System operation is explained on the example supplied with the present program located in the sample data directory **`AdvVisual-0.2/examples/test`**.

6.1. Procedure for Client Module Execution

Execution of the Client module can be started from the shell by typing its name.

```
$ advvis
```

The Main window appears on the screen when the Client module starts to run (Fig. 6-1).

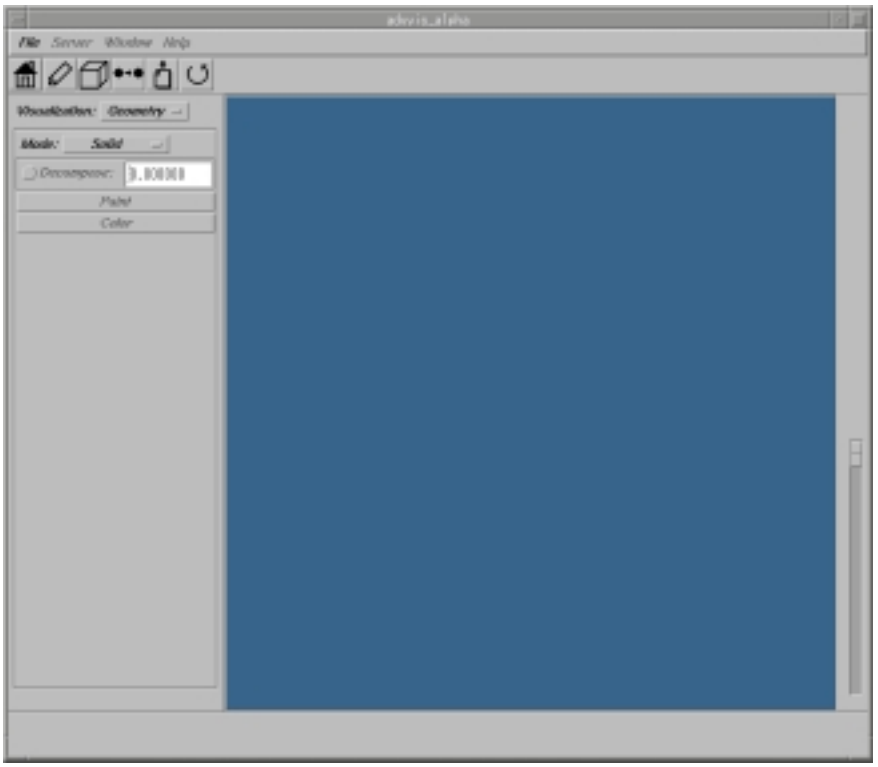

Fig. 6-1. Main Window

6.2. Selection of Input Data

To select the input data file (INP), choose the item ***Open*** (Fig. 6-2) in the menu ***File***. The dialog shown in Fig. 6-3 will appear on the screen. Select the necessary input file in the windows ***Directories*** and ***Files***. The selected file with its path will appear in the line ***Selection***. To confirm and close the dialog box, click ***OK*** button. Fig. 6-3 shows the selected INP file **`AdvVisual-0.2/examples/test/test.inp`**.

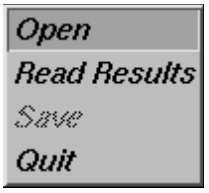

*Fig. 6-2. Menu **File***

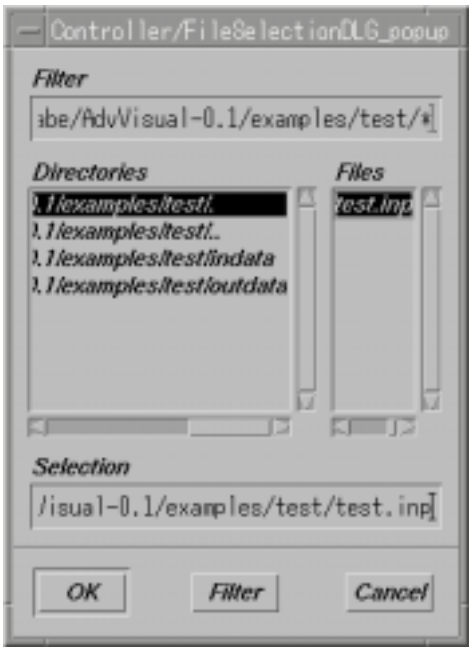

Fig. 6-3. Example of selecting INP file

6.3. Setup Procedure for Server Module

The Server module is consisted of Master process and Slave processes. The Master process controls the Slave processes, which take charge of analysis data set and communicates with the Client module. The setup procedure for each process is described below.

1. Select the command ***Initialize*** in the menu ***Server*** of the main window. The dialog box of Server module setup will appear (Fig. 6-4).

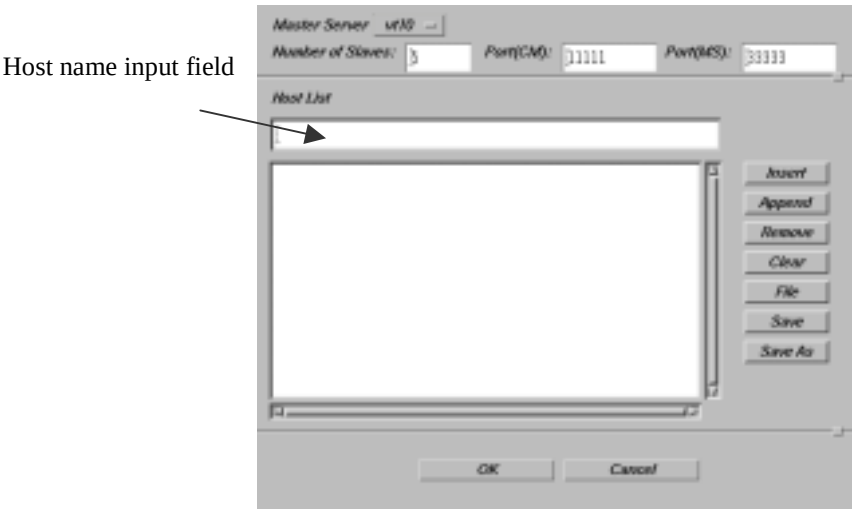

Fig. 6-4. Server Module Setup Dialog

2. The hosts that are registered in the SYS file can be displayed by selecting the Master Server Menu in the Server module setup dialog. Select the Server module that will be used as the Master server module (Fig. 6-5).

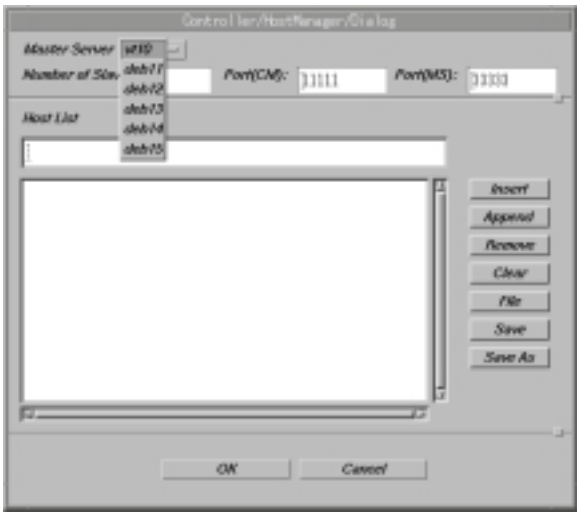

Fig. 6-5. Selection of Host Name for Master

3. Input the host name for Slave in the field ***Host List*** using the edit buttons on the right side of the dialog box (Fig. 6-6).

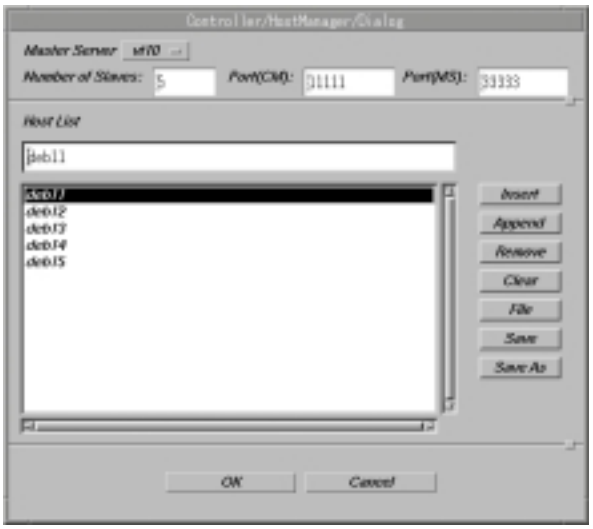

Fig. 6-6. Input of Host Name for Slave

- Addition of host name
  The item is added if the host name is input into the input field and ***Insert*** or ***Append*** buttons are clicked. If the list of hosts appeared in the dialog window, the selected item is displayed by reversed colors. The host name typed in the ***Host List*** field will be added to the list before the selected item if the ***Insert*** button is clicked. When the ***Append*** button is clicked, the item is added to the list after the selected item. If none of hosts is selected form the list, the typed item will be added to the top of the list if the ***Insert*** button is used, and to the end of the list if the ***Append*** button is used.
- Correction of host name
  The item is can be edited in the input field by clicking on the item to be corrected.
- Deletion of host name
  To delete the host name, select the item to be deleted and click on the ***Remove*** button. To delete all the items, click on the ***Clear*** button.
- Saving data to file
  To save the input host name data in a file, click on the ***Save*** button. If the data have not been saved previously, the dialog window for file name input will appear and the new file name should be input.
- Input from file
  To input the data from a file (if the host name data have been previously saved), click the ***File*** button of the dialog menu. In this case, the item(s), which has already been input, will be deleted.

4. When the input is completed, click the ***OK*** button to close the dialog. The dialog will not be closed if the input host name is not registered in the SYS file. In that case, the input of the SYS file should be confirmed.

6.4. Connection and Execution of Server Module

1. Select the item ***Control*** from the menu ***Server*** of the main window. The Server control dialog shown in Fig. 6-7 will appear on the screen.

Fig. 6-7. Dialog for Server Control

2. To start the Server, which will be used as Master, click the button ***Start*** of the Server control dialog.
3. Connect the server for Master clicking the button ***Connect***.
4. If the connection to the Server for Master is completed, information will be shown in the dialog box (Fig. 6-8).

Fig. 6-8. Start of Server for Master

6.5. Input of Analysis Model Data Set

1. To input the data of the model for analysis, click the button ***Read Analysis Model Dataset*** (***RAMD*** button) of the Server control dialog.
2. When the analysis model data are input in parallel, the toggle buttons ***Parallel Mode*** on the right of the ***RAMD*** button is checked. If the toggle buttons ***Parallel Mode*** are not selected, the input process of the analytical model data is done sequentially.
3. The graphics display can be done when the input of the analytical model data set is completed.

6.6. Input of Analysis Results Data Set

1. Clicking the ***Read Results Dataset*** (***RRD***) button of the Server control dialog can open the input dialog of analysis result data set (Fig. 6-9).
2. When the analysis result data are input in parallel, the toggle buttons ***Parallel Mode*** on the side of the ***RRD*** button is checked. If the toggle buttons ***Parallel Mode*** are not selected, the input process of the analytical result data is done sequentially.

Fig. 6-9. Input Dialog for Analysis Result Data Set

3. The variables of analysis results are displayed in the input dialog for the analysis result data set. Input variables of the analysis results can be selected. Possible input variables are presented in the example shown in Fig. 6-9.

`AllNodeVariable:Displacement:v3` Node displacement（vector）
`AllNodeVariable:ReactionForce:v3` Reaction force (vector)
`AllElementVariable:Stress:t3` Element's stress (tensor)
`AllNodeVariable:NodalStress:t3` Nodal stress (tensor)
`AllElementVariable:Strain:t3` Element's strain (tensor)
`AllNodeVariable:NodalStrain:t3` Nodal strain (tensor)
`AllElementVariable:EquivalentStress:s` Element's equivalent stress (scalar)
`AllNodeVariable:NodalEquivalentStress:s` Nodal equivalent stress (scalar)

When vector- (tensor-) type data are input, the component can be selected from the ***Vector*** (***Tensor***) option menu of the input dialog for analysis result data set. In the current version, only the scalar, the vector, and the tensor data can be input.

4. Click the ***Load*** button. When the process is over, the dialog window can be closed clicking the ***Cancel*** button.

7. Display of Visualized Information

The image of the analytical model is displayed in a view area of the main window.

7.1. Functions of TOOL Buttons

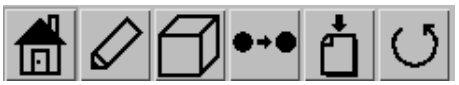

Fig. 7-1. Tool Buttons

The functions of the tool buttons are shown below.


Reset button
Used for returning to the initial state if the aspect is moved.


Redraw button
Re-drawing.


Transform button
Fluorography transmutation / Orthogonal projection transmutation are switched. The default is Fluorography transmutation. If the Fluorography transmutation is selected, the picture of the Transform button (Orthogonal projection transmutation)  is displayed. If the Orthogonal projection transmutation is selected, the picture of (Fluorography transmutation)  is displayed in the Transform button.


Interactive button
Switch whether draw only by point （Interactive mode OFF or ON） while aspect is moving. The interactive mode is set to ON for the default. When an interactive mode is turned on, the picture of the interactive button (interactive mode is OFF) is displayed  . The picture  of the Interactive button (the mode is ON) is displayed when an interactive mode is off.


Save button
Contents of the display are saved in the PPM format image file.

1. To save the data, select the ***Save*** button. The file selection dialog (Fig. 7-2) will be displayed.

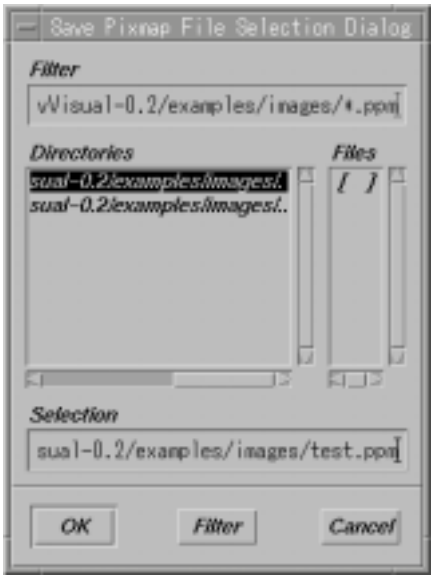

Fig. 7-2. File Selection Dialog

2. Input the name for saved file (Extension **`.ppm`**) and click the ***OK*** button.


Rotate button

The dialog for rotation operations is shown in Fig. 7-3. To rotate the view, move the slider or insert the numerical value (from 0 to 360) in the window, confirming it by pressing the Return (Enter) key. The object can be moved (rotated) from the initial position relatively to X-axis, Y-axis, and Z-axis.

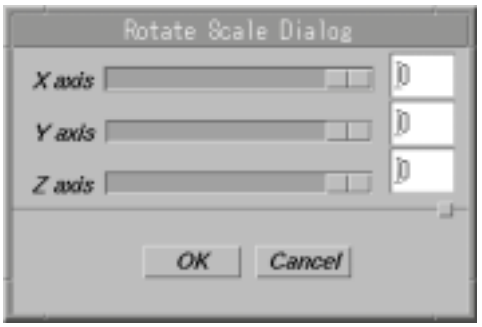

Fig.7-3. Dialog for Rotation Operation

7.2. Change the “Viewpoint” and Zoom the Display

The cursor can be moved while pushing the mouse button to move the aspect on the View window. Table 7.1 shows the operational commands.

Table 7.1. Operational Commands

Movement of aspect	*Button*
Right and left	Left
The top and bottom	Left
The back and forth	Right
Rotation of horizontal direction which centers on object	Middle
Rotation of vertical direction which centers on object	Middle
Rotation around the axis vertical to the screen	Left + Shift Key

7.3. Display of Analysis Model Shape

The meshes read from the Server module are displayed. The display can be switched by selecting the item ***Geometry*** from the pop-up menu ***Visualization*** of the main window.

7.3.1. Solid Display

By clicking the item ***Solid*** in the ***Mode*** pop-up menu, the object will be shown as solid (Fig. 7-4).

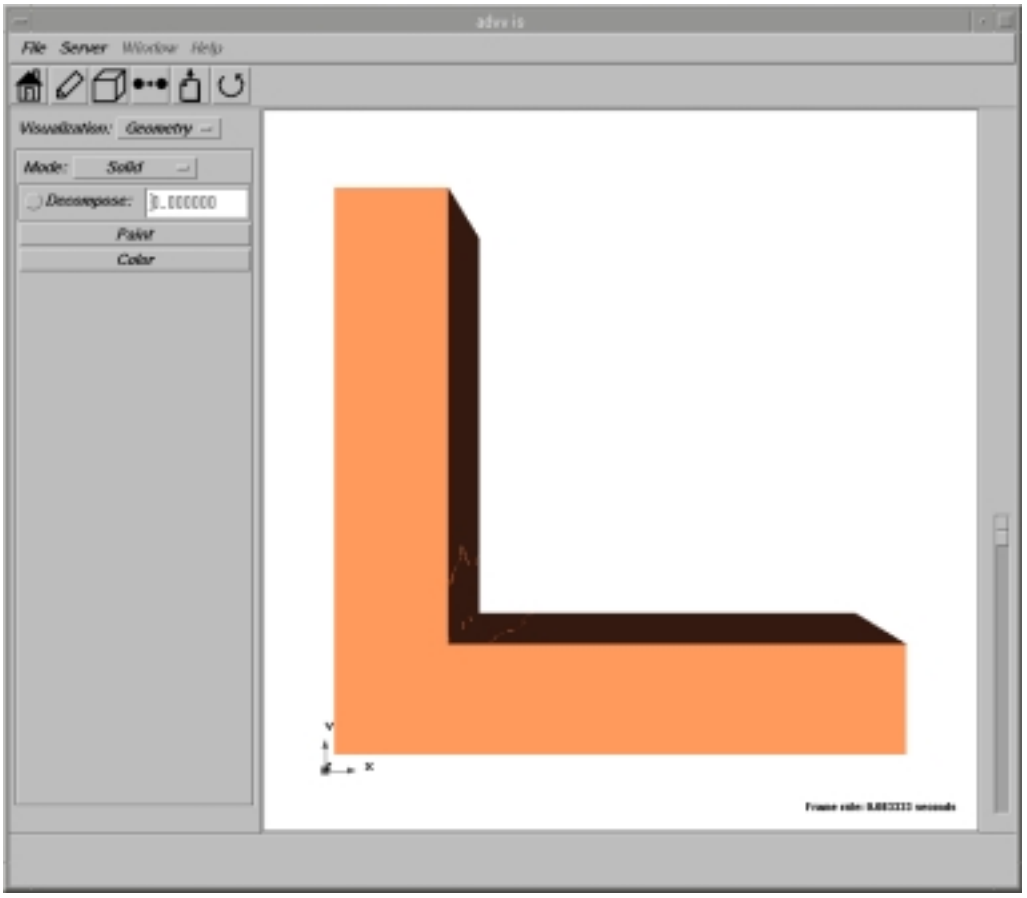

Fig. 7-4. Solid Display

7.3.2. Mesh Display

The screen changes from the state of 7.3.1 (Fig. 7-4) into Fig. 7-5 when ***Mesh*** is selected in the ***Mode*** pop-up menu.

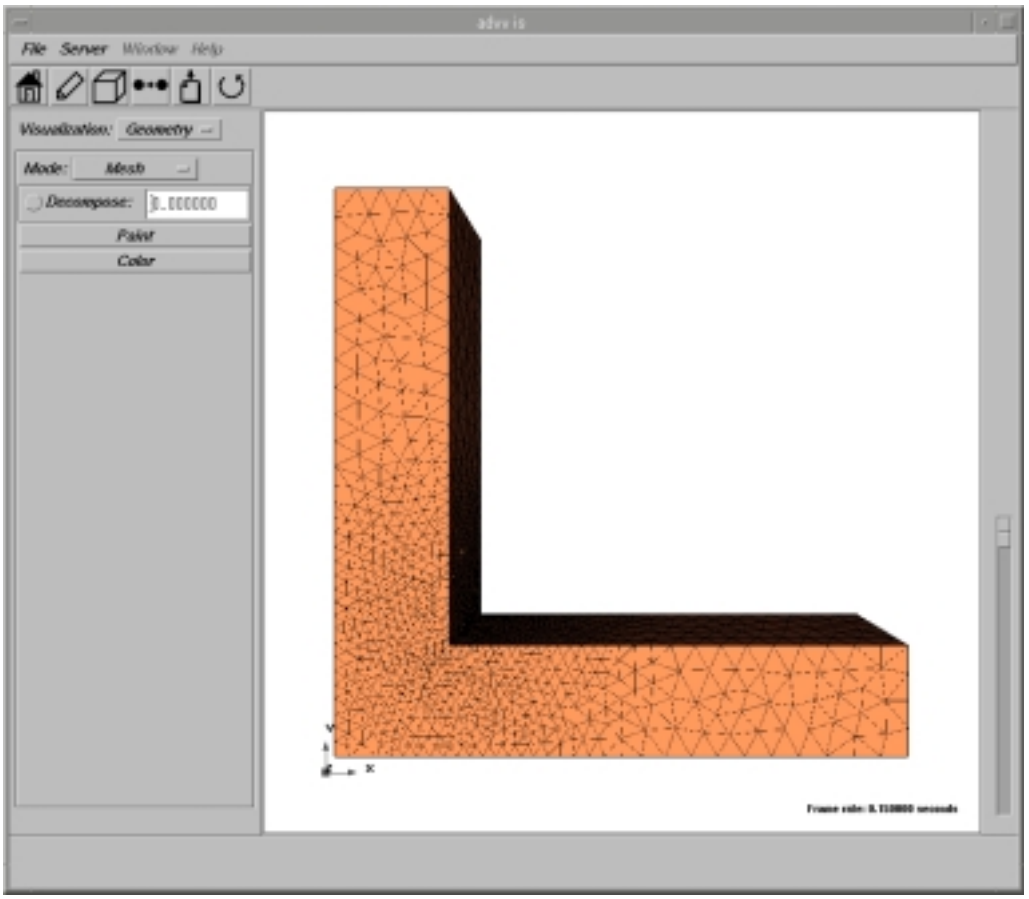

Fig. 7-5. Mesh Display

7.3.3. Domain Decomposition Display

The part of hierarchical domain decomposition is displayed. When the ***Paint*** button is clicked from the state of 7.3.2 (Fig. 7-4), the meshes of each part are classified as shown in Fig. 7-6. To return to the initial display, click the ***Paint*** button again.

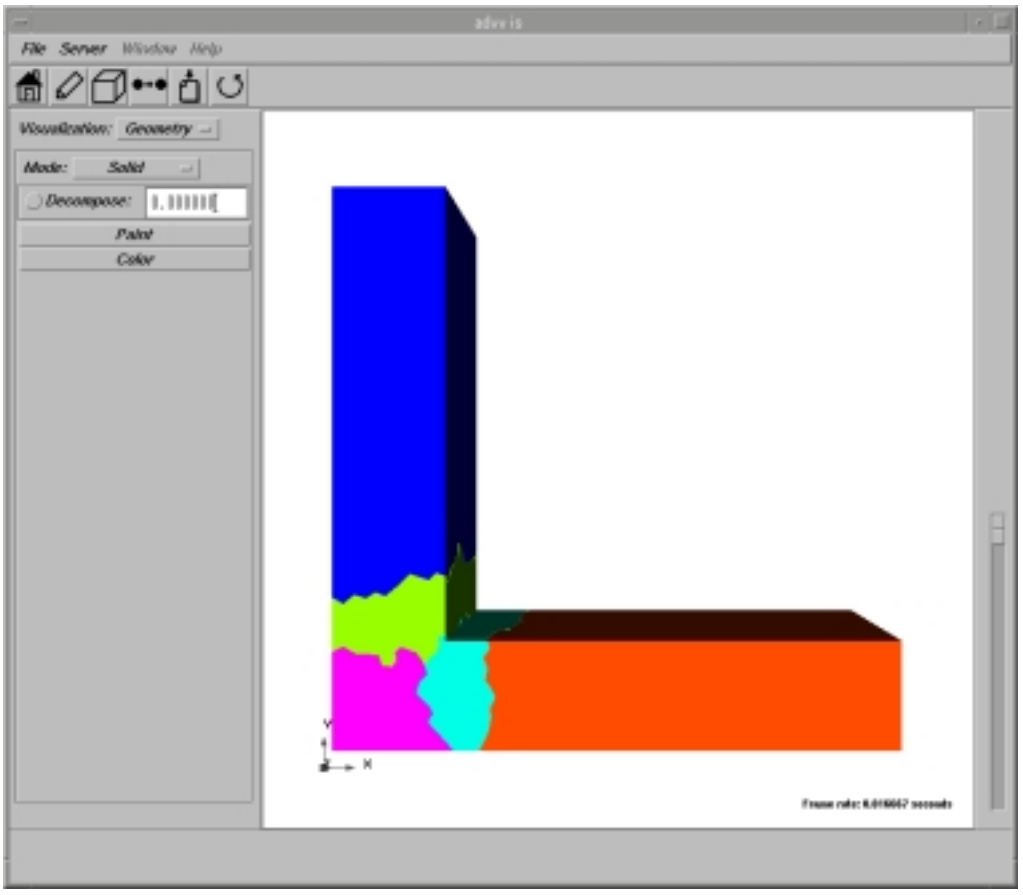

Fig. 7-6. Domain Decomposition Display

The domain decomposition can be displayed in various ways by changing the ***Decompose*** factor. If the ***Decompose*** factor ($\geqq 0$) is input into the input field by the decimal value, and the toggle button on the left is turned on, the decomposed domains will be shown separated from each other by distance. The separation distance is calculated taking into account the distance between the center of gravity of the entire model and the center of gravity of each of the decomposed domain, multiplying it by the input decompose factor. Changes in decompose factor with pressing the toggle button, reflects in the display of the decomposed domain. When the toggle button is turned off, the decompose factor is set to the default value (0.000000).
The cases shown in Fig. 7-7 and Fig. 7-8 are corresponded to the decompose factors of 0.1 and 0.5, respectively. The initial case with decompose factor of 0.0 is shown in Fig. 7-6.

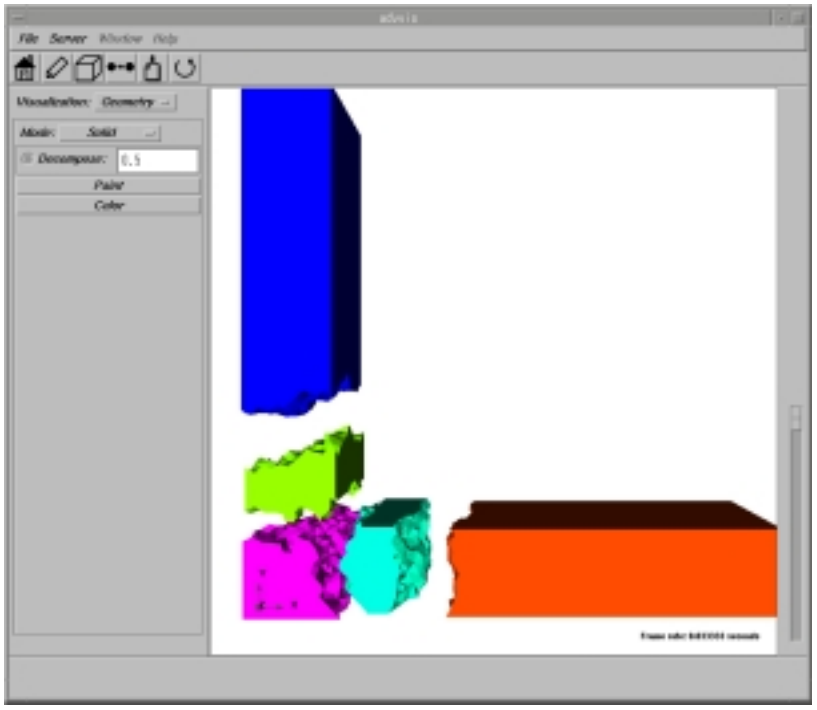

Fig. 7-7. Domain Decomposition Display (for Decompose factor = 0.5.)

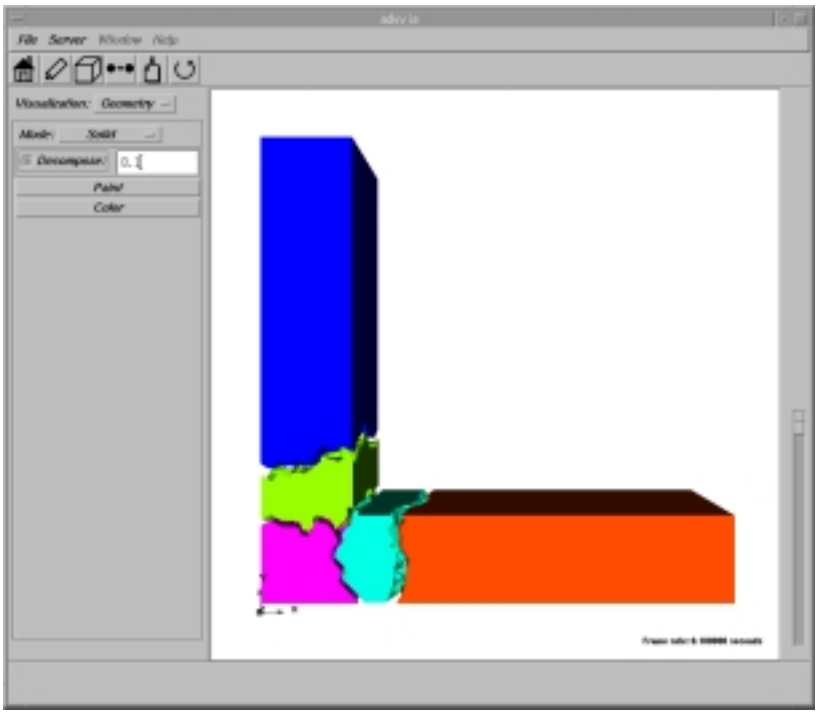

Fig. 7-8. Domain Decomposition Display (for Decompose factor = 0.1)

7.3.4. Wire Frame Display

Only the borderline of the mesh is displayed in this mode. The display mode changes as shown in Fig. 7-9 from the state discussed in Chapter 7.3.1 (Fig. 7-4), when the ***Wireframe*** mode is selected in the ***Mode*** pop-up menu.

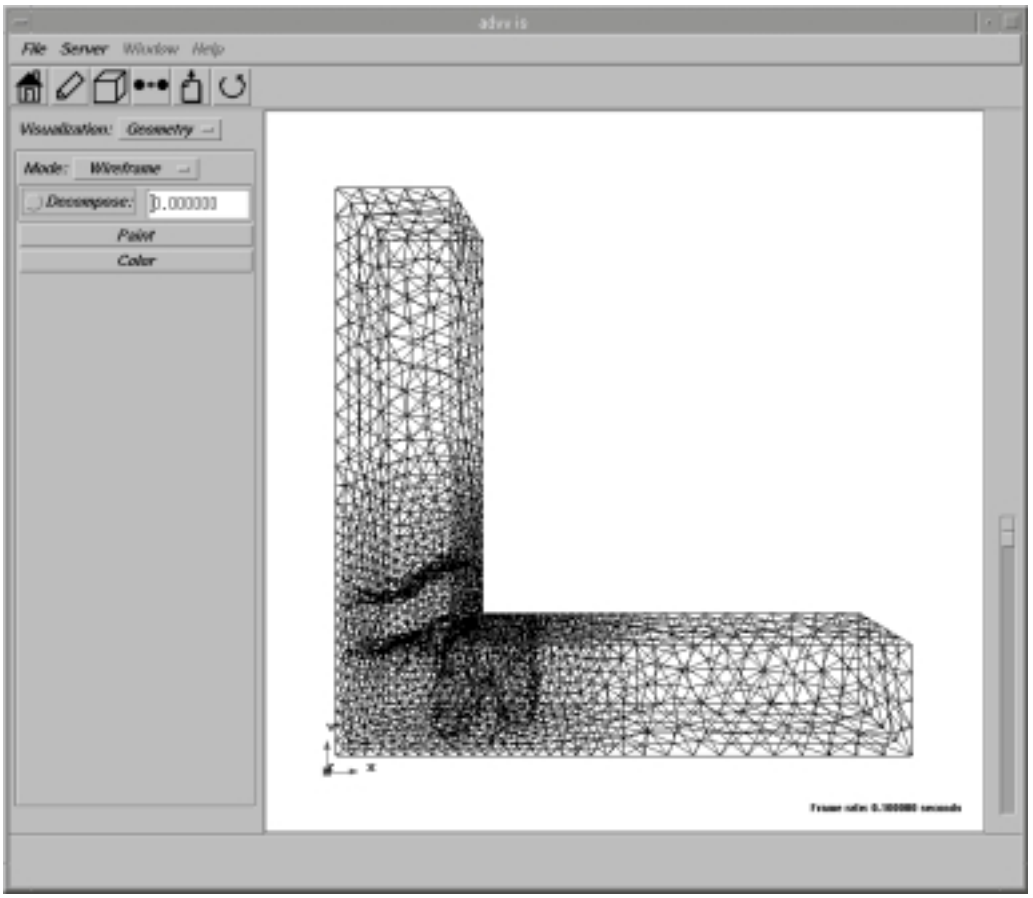

Fig. 7-9. Wire Frame Display

7.3.5. Bounding Box Display

The hexahedron vicinity, which includes the object, is displayed in this mode. The display changes as shown in Fig. 7-10 from the state discussed in Chapter 7.3.1 (Fig. 7-4), if the ***Bounding Box*** mode is selected in the ***Mode*** pop-up menu.

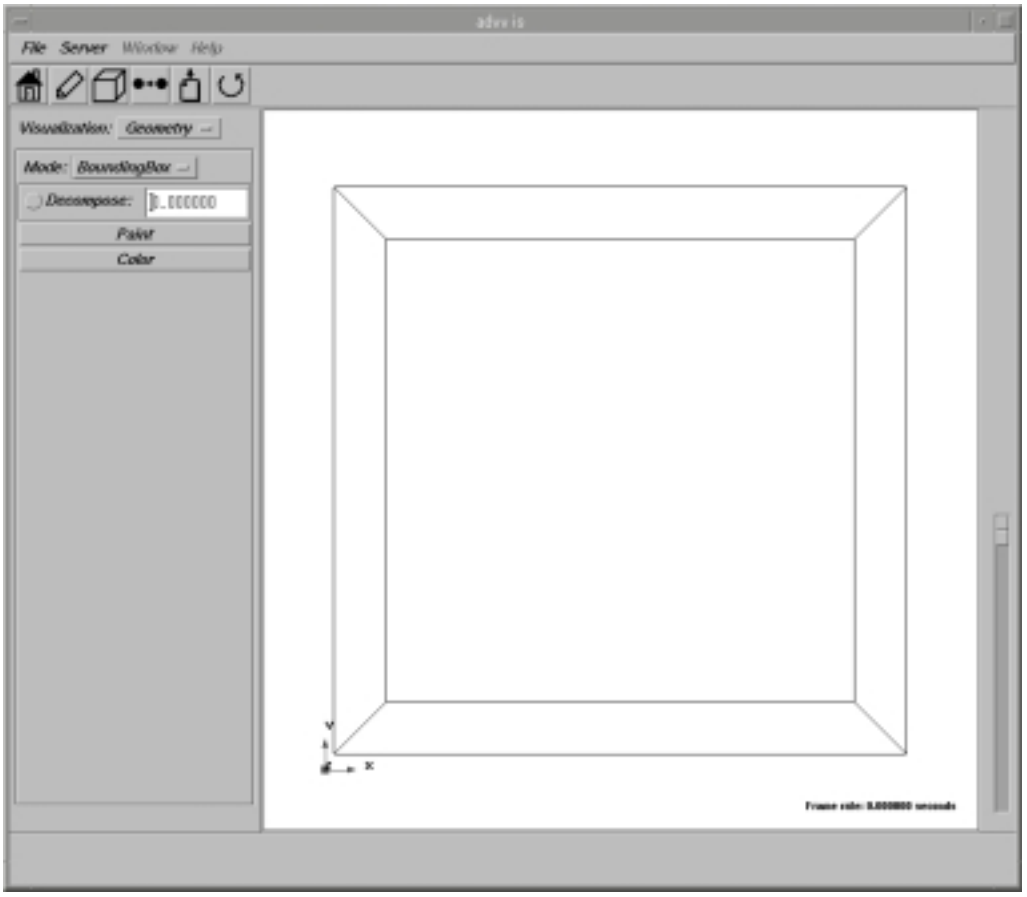

Fig. 7-10. Bounding Box Display

7.4. Scalar Distribution Display

The item ***Surface*** selected from the ***Visualization*** pop-up menu of the main window switches the display.

7.4.1. Surface Scalar Distribution Display

Fig. 7-11 is displayed if the item ***Scalar*** is selected in the ***Mode*** pop-up menu.

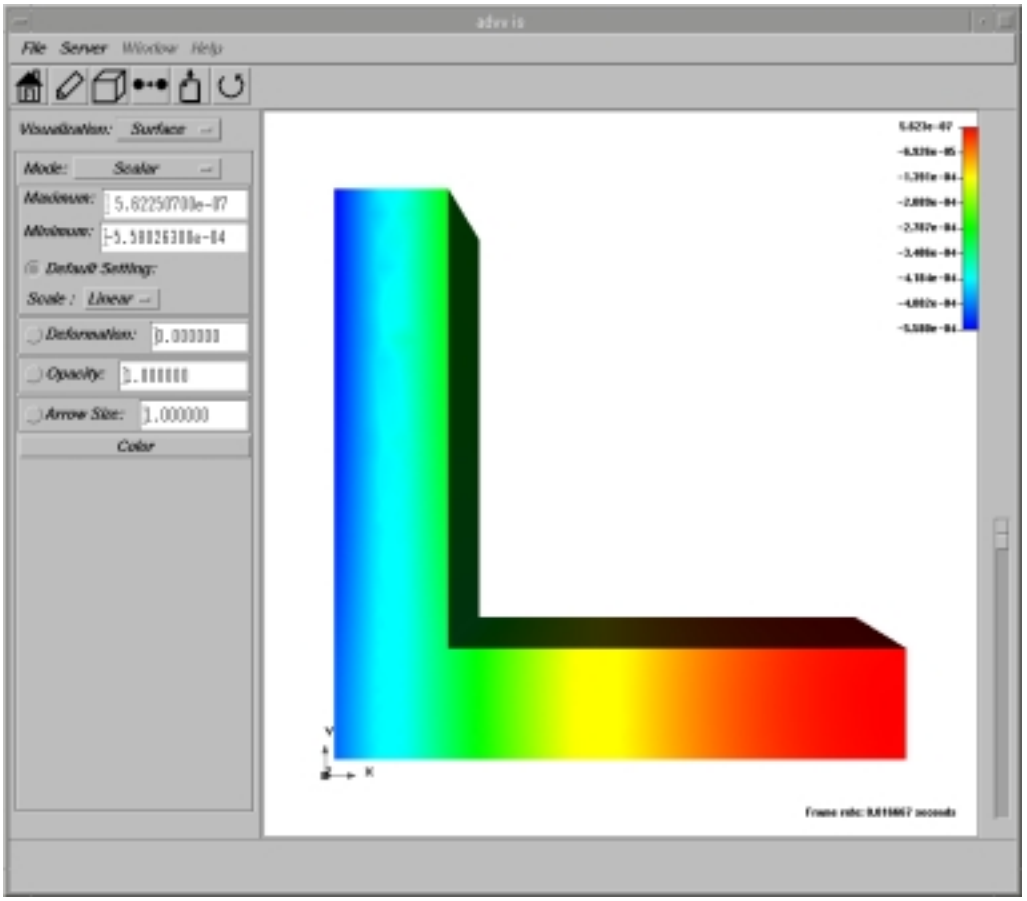

Fig. 7-11. Surface Scalar Distribution Display

The range of the scalar value can be changed in the ***Maximum*** input field and the ***Minimum*** input field at the left side of the window. The value is set to the default if the toggle button is pressed. If the ***Default Setting*** toggle button is turned off, the values input into the fields will be used and the display range will be changed. The display of the scalar value more than the value set in ***Maximum*** is shown by the red color, and the

display of the scalar value below the value set in ***Minimum*** is displayed by the blue color. The maximum value of the scalar value is set in ***Maximum*** when the ***Default Setting*** toggle button is turned on and the minimum value of the scalar value is set to ***Minimum*** again.

Fig. 7-12 shows an example of setting the ***Maximum*** and the ***Minimum*** input fields to - 0.0004 and - 0.0003 respectively from the state shown in Fig. 7-11.

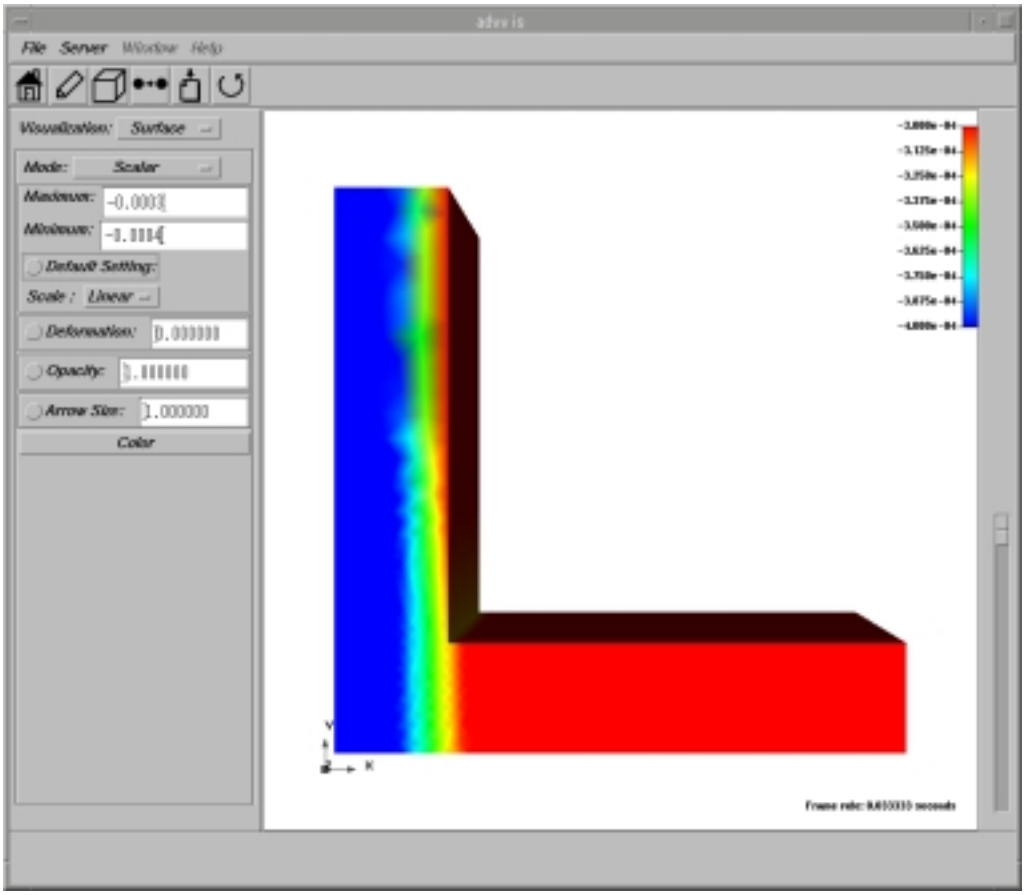

Fig. 7-12. Scalar distribution display (Maximum = -0.0003, Minimum = -0.0004)

7.4.2. Mesh Display

When ***Scalar and Mesh*** option in the ***Mode*** pop-up menu is selected from the state discussed in Chapter 7.4.1 (Fig. 7-11), the display changes as shown in Fig. 7-13.

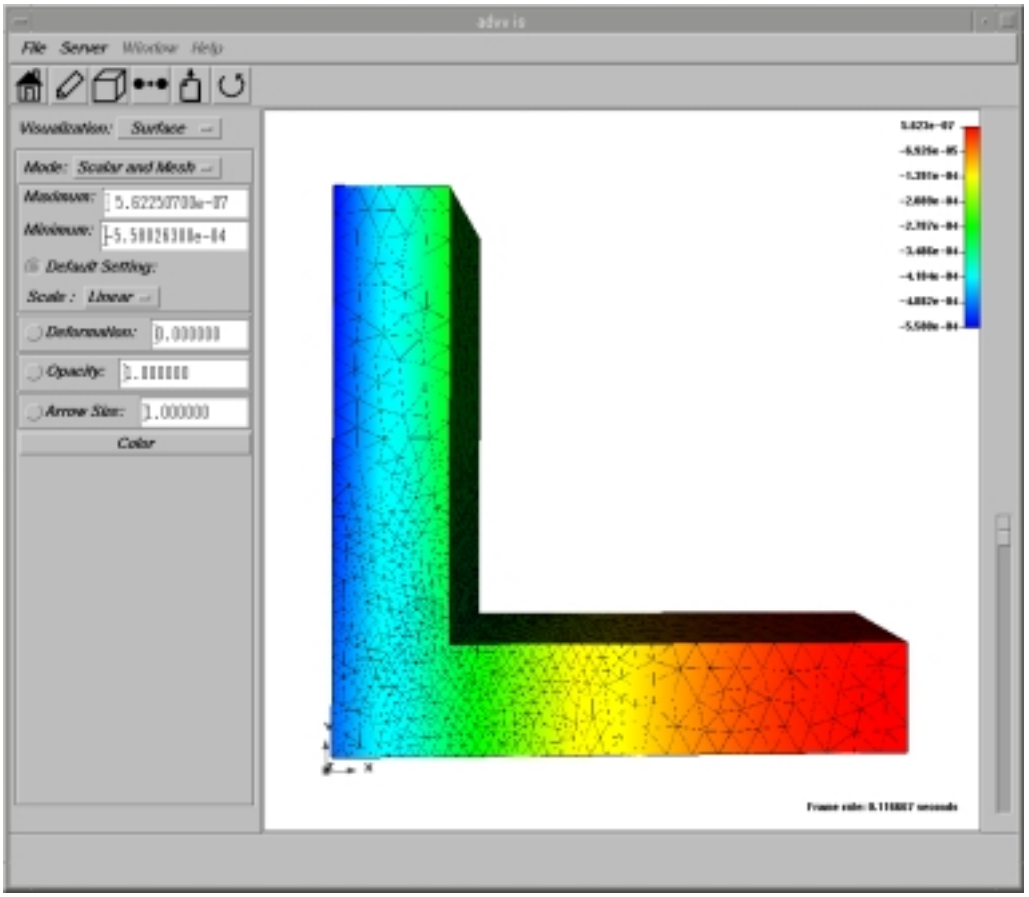

Fig. 7-13. Mesh Display

7.4.3. Display of Displacement Distribution

There are two methods to show the displacement distribution. One is ***Disp Norm*** mode when the size of displacement is shown by length of arrows in black and white; and the other is ***Disp Color*** mode, when the arrow length is the same as the maximum value of the normal, and the values of displacement are displayed by color.

The scale of displacement can be changed for each mode. The displacement is shown when the value of the factor ($\geqq 0$) is input into the input field labeled ***Arrow Size***, and, if the toggle button is turned on, the value times factor is displayed. If the toggle button is off, the factor is set to its default value (1.000000).

In the state of Fig. 7-11 (discussed in Chapter 7.4.1), the value of 100 is input into the field labeled ***Arrow Size***, and the following two examples, Fig. 7-14 and Fig. 7-15, display the actual displacement multiplied by 100.

The display changes as shown in Fig. 7-14 when ***Disp Norm*** of the ***Mode*** pop-up menu is selected.

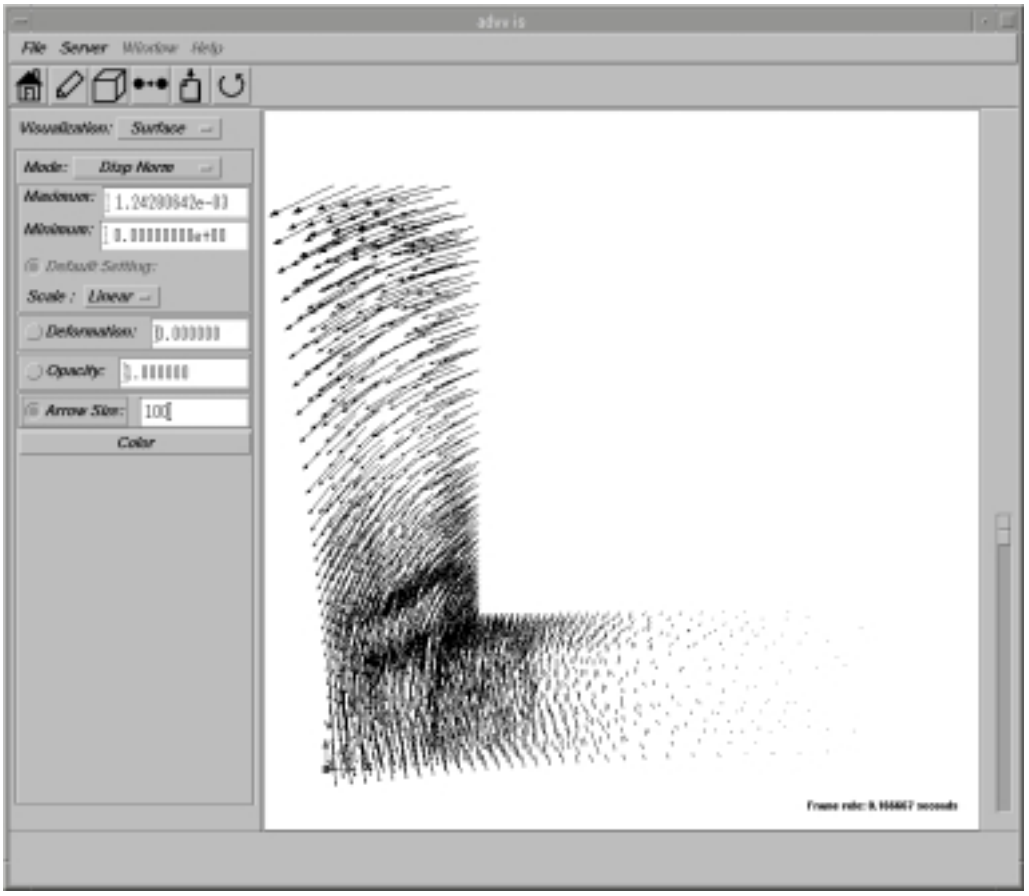

Fig. 7-14. Displacement Distribution Display (norm)

The display changes as shown in Fig. 7-15 when ***Disp Color*** of the ***Mode*** pop-up menu is selected.

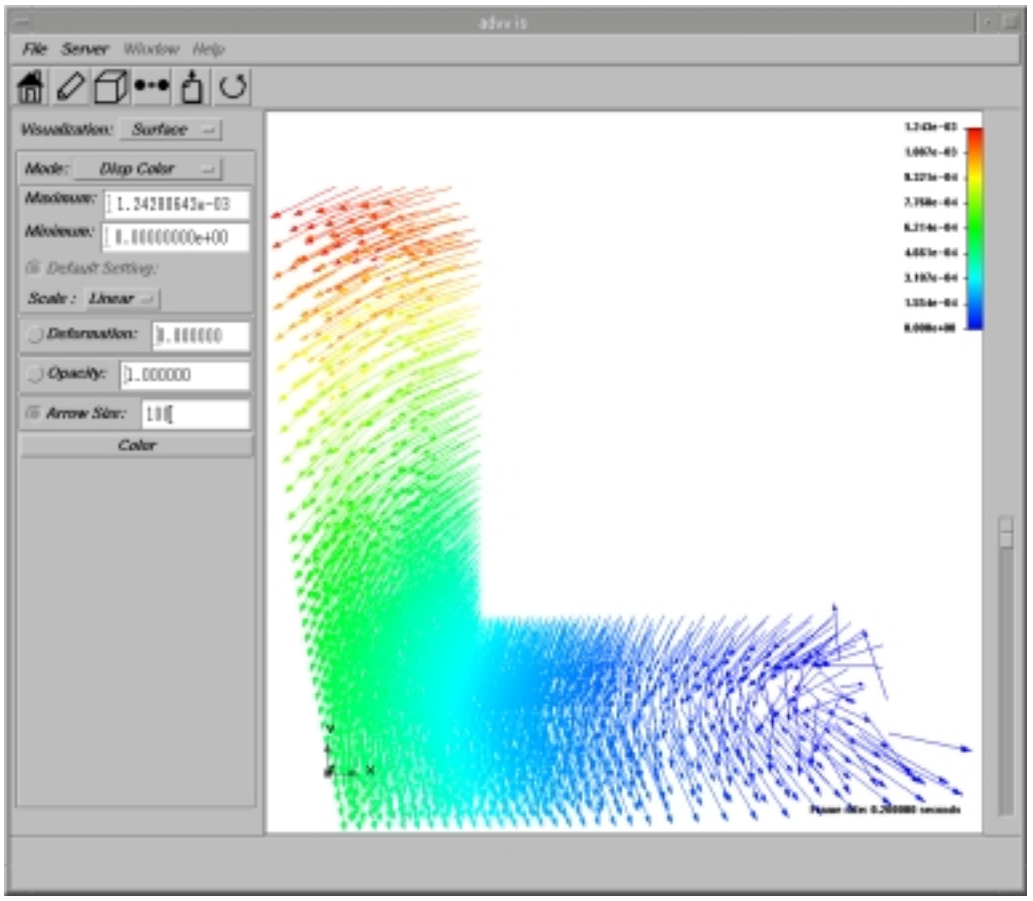

Fig. 7-15. Displacement Distribution Display (color)

7.4.4. Deformation Display

The method of displaying the deformation is presented. The deformation is displayed if the factor ($\geqq 0$) is input into the input field labeled ***Deformation*** and the toggle button is turned on. If the new value of deformation is set and the Return (Enter) key is pushed with the turned on toggle button, the changes are reflected on the display. If the toggle button is turned off, the factor is set to the default value (0.000000).

Fig. 7-16 shows an example of inputting the value of 2000 into the input field labeled ***Deformation*** of the case shown in Fig. 7-11 (Chapter 7.4.1).

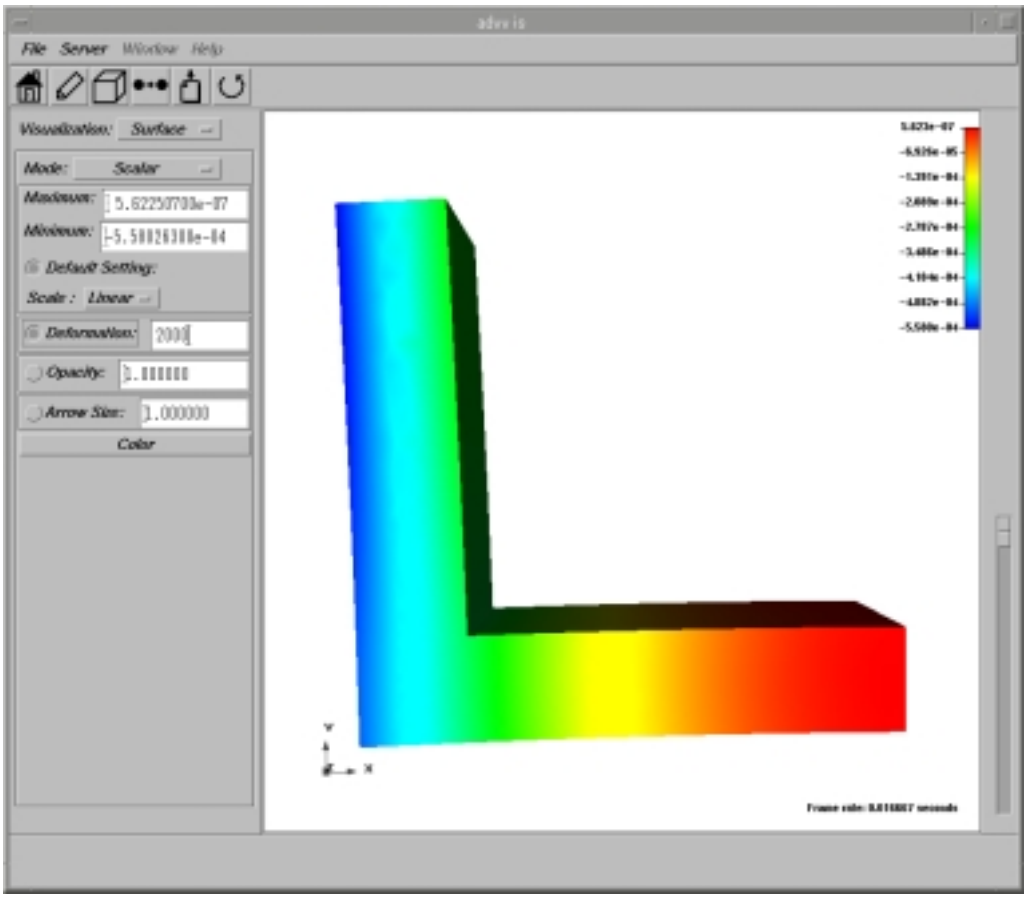

Fig. 7-16. Deformation Display

7.4.5. Half-Transparent Display

The method of half-transparent display of the scalar distribution is presented. If the opacity degree (vary from 0 to 1) is input into the input field labeled ***Opacity*** by a decimal value, and the toggle button is turned on, the scalar distribution is half-transparently displayed. Input of another value with turning the toggle button on and pushing the return key will be reflected on the display. If the toggle button is turned off, the opacity degree is set to the default value (1.000000).

Fig. 7-17 shows an example of selecting ***Mix*** mode from the state discussed in Chapter 7.4.3 (Fig. 7-14) by inputting the value of 0.3 into the input field labeled ***Opacity*** of the ***Mode*** pop-up menu. The internal displacement distribution can be seen though the scalar distribution if the scalar distribution display has been half-transparently done in the ***Mix*** mode.

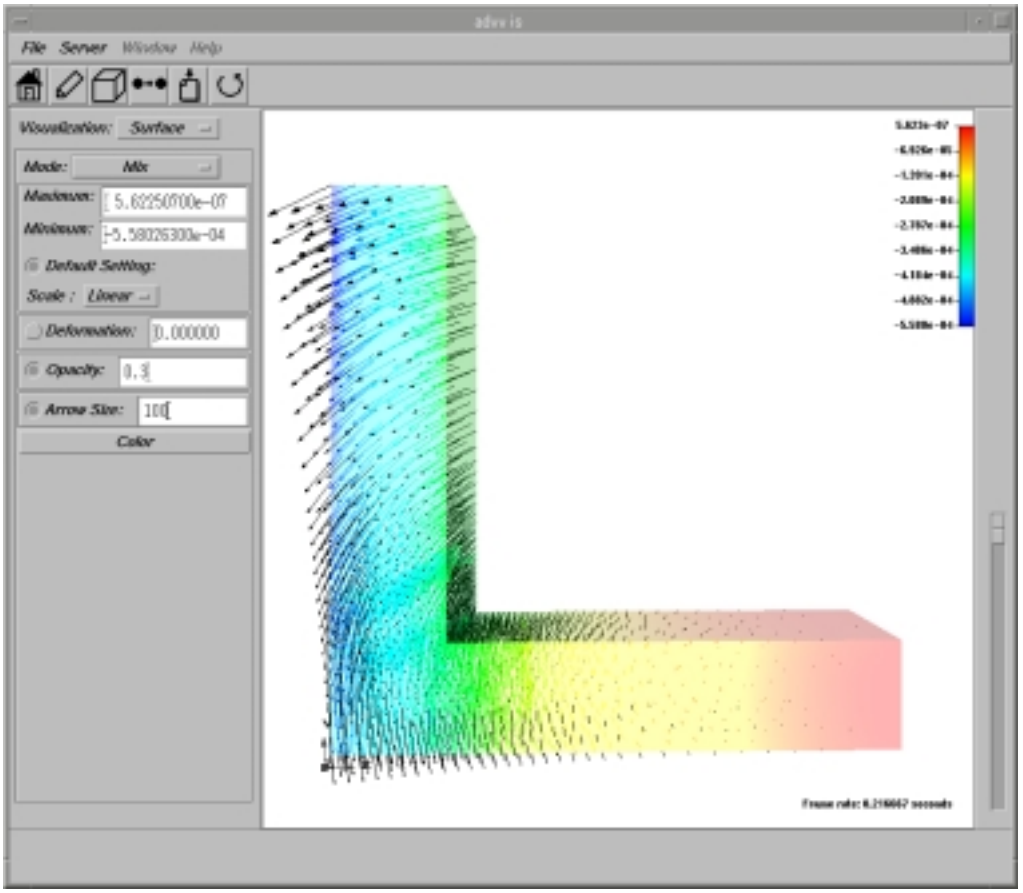

Fig. 7-17. Half-transparent Display (Opacity = 0.3)

7.5. Section of Scalar Distribution Display

When item ***Cut Plane*** is selected from the ***Visualization*** pop-up menu of the main window, only the surface of the object is displayed as it is shown in Fig. 7-18.

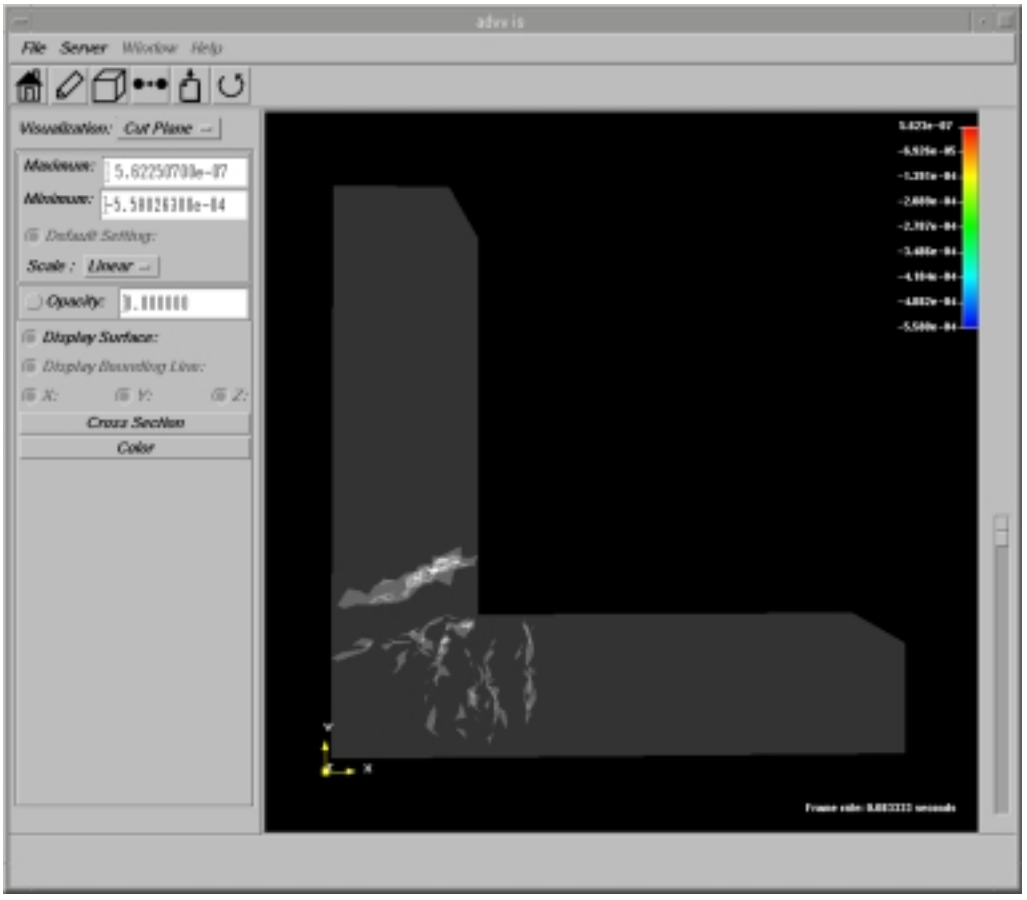

Fig. 7-18. Initial Screen of Section Scalar Distribution Display

The Method to Display the Section Scalar Distribution

1. Click the ***Cross Section*** button on the panel at the left of the main window, and the section extraction dialog shown in Fig. 7-19 will be displayed.

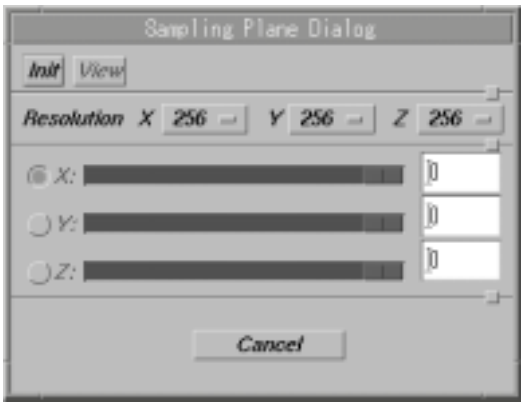

Fig. 7-19. Section Extraction Dialog

2. Click the ***Init*** button on the left in the section extraction dialog to initialize the initial settings for the section extraction. The ***View*** button of the section extraction dialog, the ***Resolution*** pop-up menu of each ***X***, ***Y***, and ***Z*** toggle buttons, the sliders, and the input fields will become effective after the initialization. It is shown in Fig. 7-20.

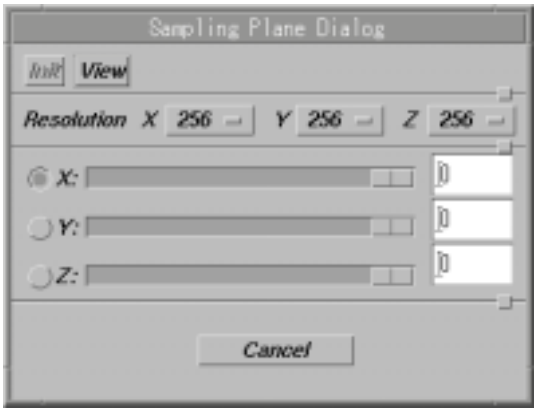

Fig. 7-20. Initialized Section Extraction Dialog

The bounding box is displayed as shown in Fig. 7-21.

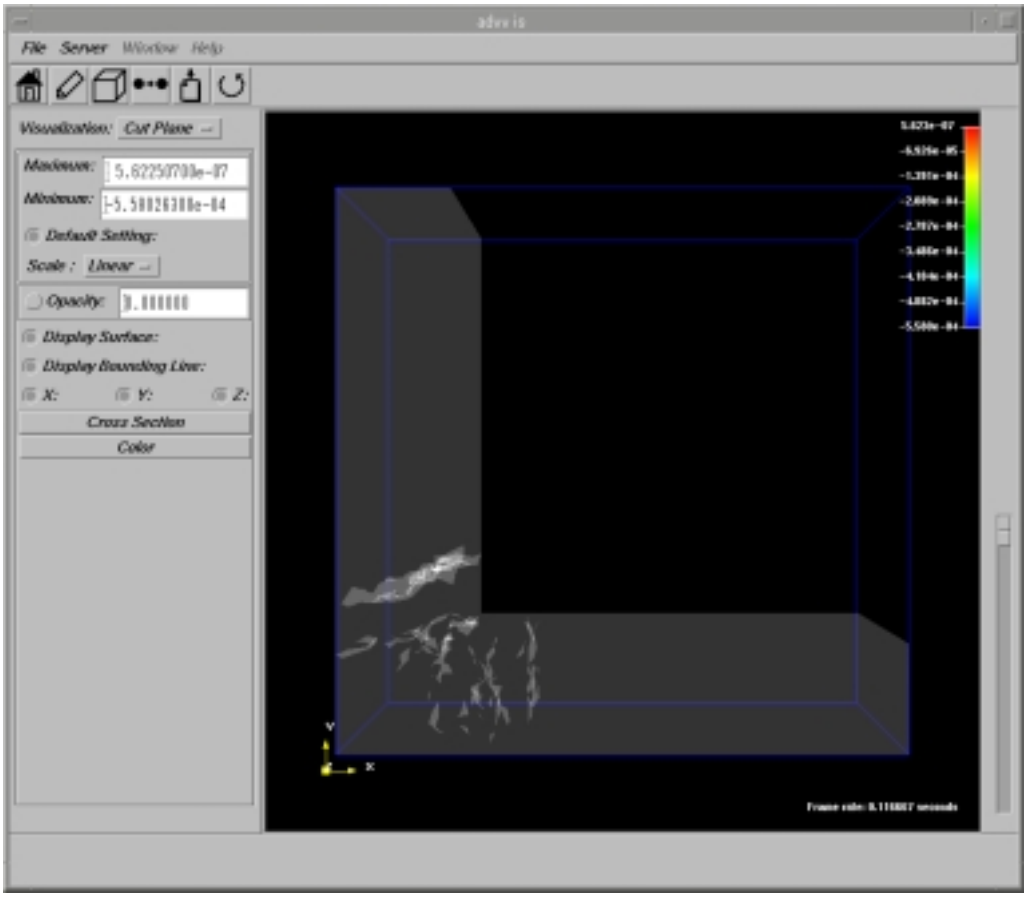

Fig. 7-21. Initialized Section Scalar Distribution Display

3. The resolution of section display can be selected in the ***Resolution*** pop-up menu for each ***X, Y,***and ***Z*** from 256, *512*, and *1024*. Here, the resolution is a standard how detailed the cross section will be shown in each direction. To obtain the detailed distribution, the resolution should be made large, and to obtain the distribution in a short time with rough details, the resolution should be made small.

   In addition, the position of extracted section can be set using input fields or toggle buttons of each slider.

   The section set here is only the vertical face against either ***X, Y, Z*** axis. For example, if the settings are made for ***Z***-axis, the vertical face is set to ***Z***. The values of ***X, Y, Z***, which can be taken here, can be different according to the decided resolution. At the same position in a drawing, if the resolution is large, the set numerical value is also large in the section, because the resolution was carved detailed compared with a case when it is small.

   After confirmation of the position of section, the ***View*** button located on the left of the section extraction dialog is clicked and the section scalar distribution can be displayed. By default settings, the surface is displayed according to the section scalar distribution.

Fig. 7-22 and Fig. 7-23 show that:

- ***X*** resolution is assumed to be ***256***, the vertical respect X=32 to ***X***-axis is set as a section, and the section scalar distribution has been extracted.
- ***Y*** resolution is assumed to be ***512***, the vertical respect Y=64 to ***Y***-axis is set as a section, and the section scalar distribution has been extracted.
- ***Z*** resolution is assumed to be ***1024***, the vertical respect Z=128 to ***Z***-axis is set as a section, and the section scalar distribution has been extracted.

An example of a sampling plane dialog is presented below.

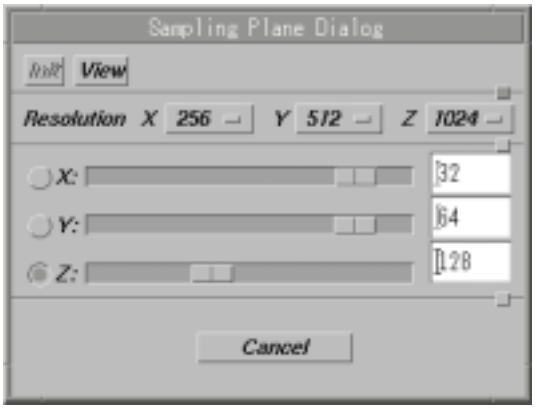

Fig. 7-22. Example of Setting Resolution and Section

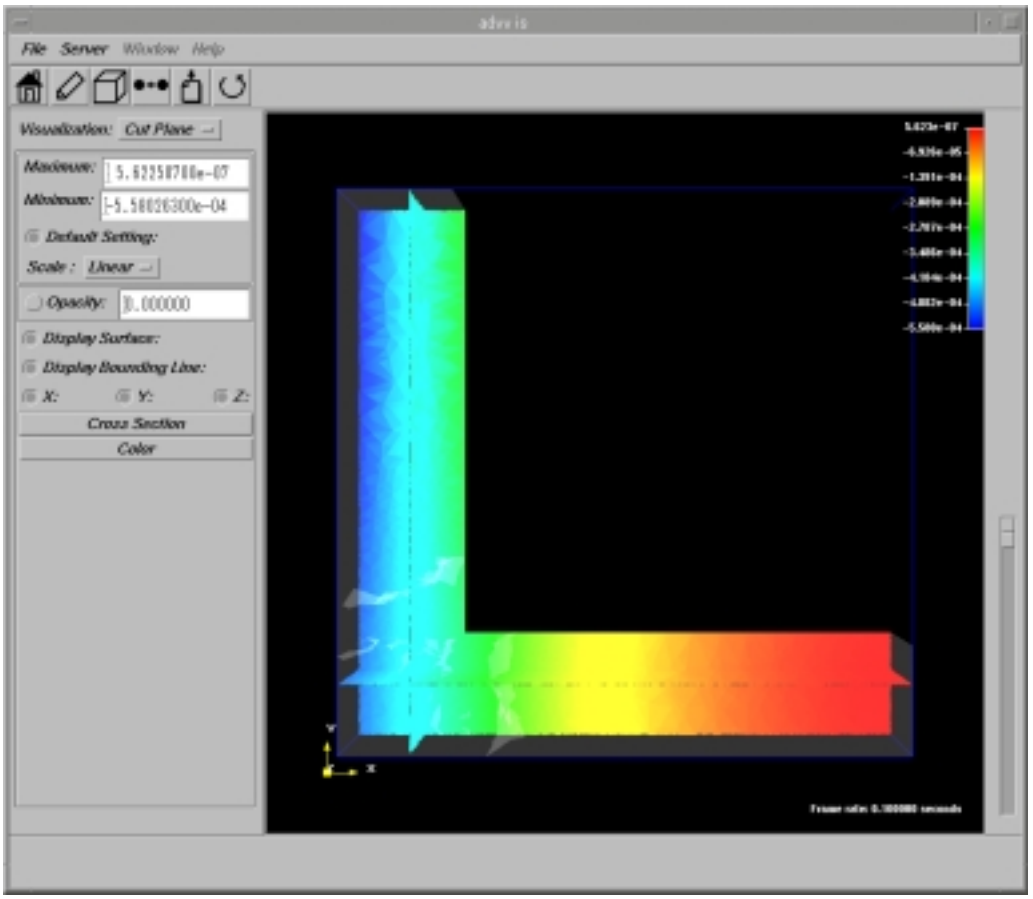

Fig. 7-23. Example of Section Scalar Distribution Display

4. The opacity degree can be set from 0 to 1 by a decimal value in the ***Opacity*** input field of the main window by turning the toggle button on. The opacity degree on the surface displayed together with the section scalar distribution can be set. The toggle button changes the opacity degree in the state of on, and the Return (Enter) key confirms the changes. When the toggle button is turned off, the opacity degree becomes 0.000000 that corresponds to the default value.

In Fig. 7-24, the opacity degree is set to the value of 0.7 from the state shown in Fig. 7-23

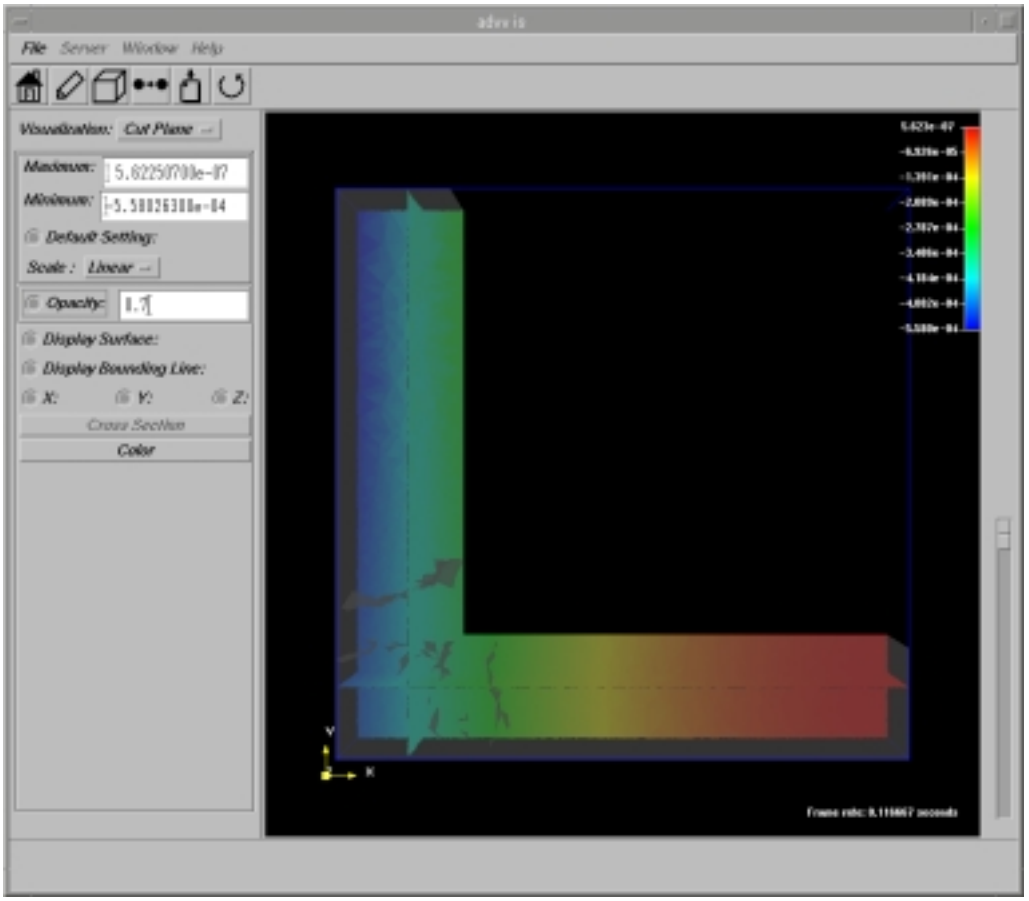

Fig. 7-24. Section Scalar Distribution Display (Opacity = 0.7)

5. When the ***Display Surface*** toggle button located on the left of the main window is turned off, the surface display is excluded as shown in Fig. 7-25. When the ***Display Surface*** toggle button is turned on, the surface is displayed together with the section scalar distribution.

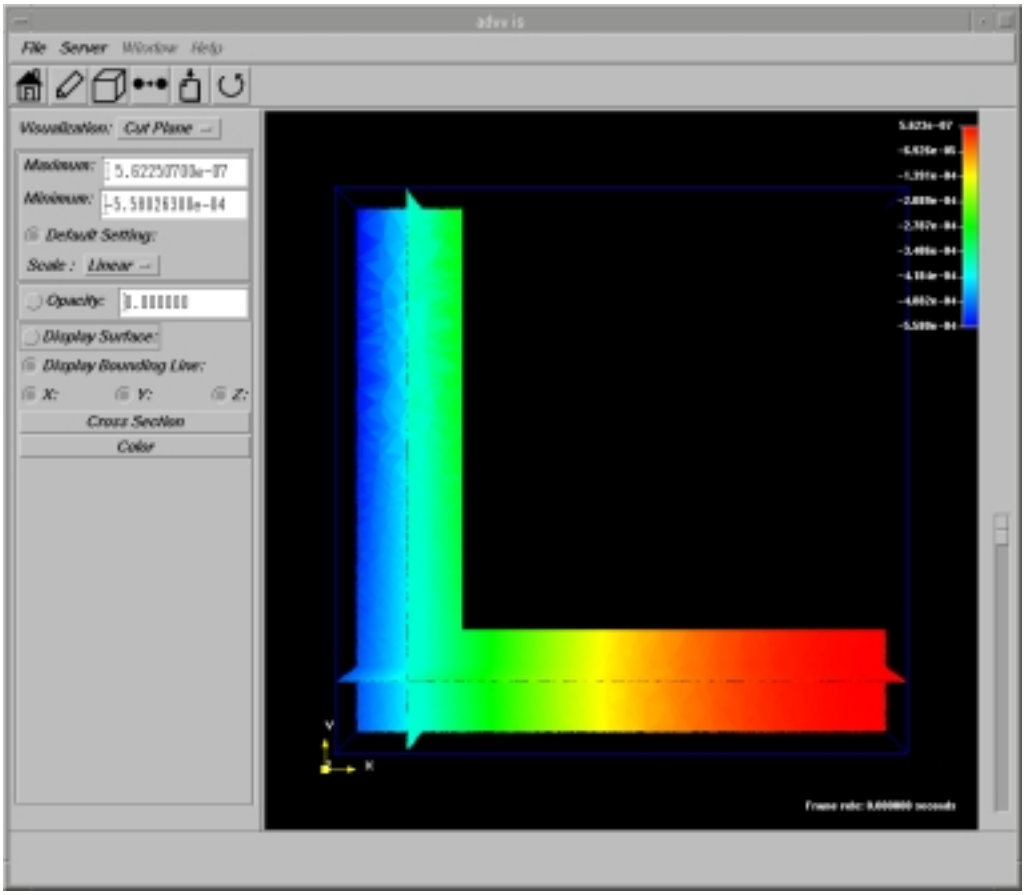

Fig. 7-25. Section Scalar Display (surface is not displayed)

6. When the ***Display Bounding Line*** toggle button located on the left of the main window is turned off, the Bounding box display is excluded as shown in Fig. 7-26. When the ***Display Bounding Line*** toggle button is turned on, the Bounding box is displayed together with the section scalar distribution.

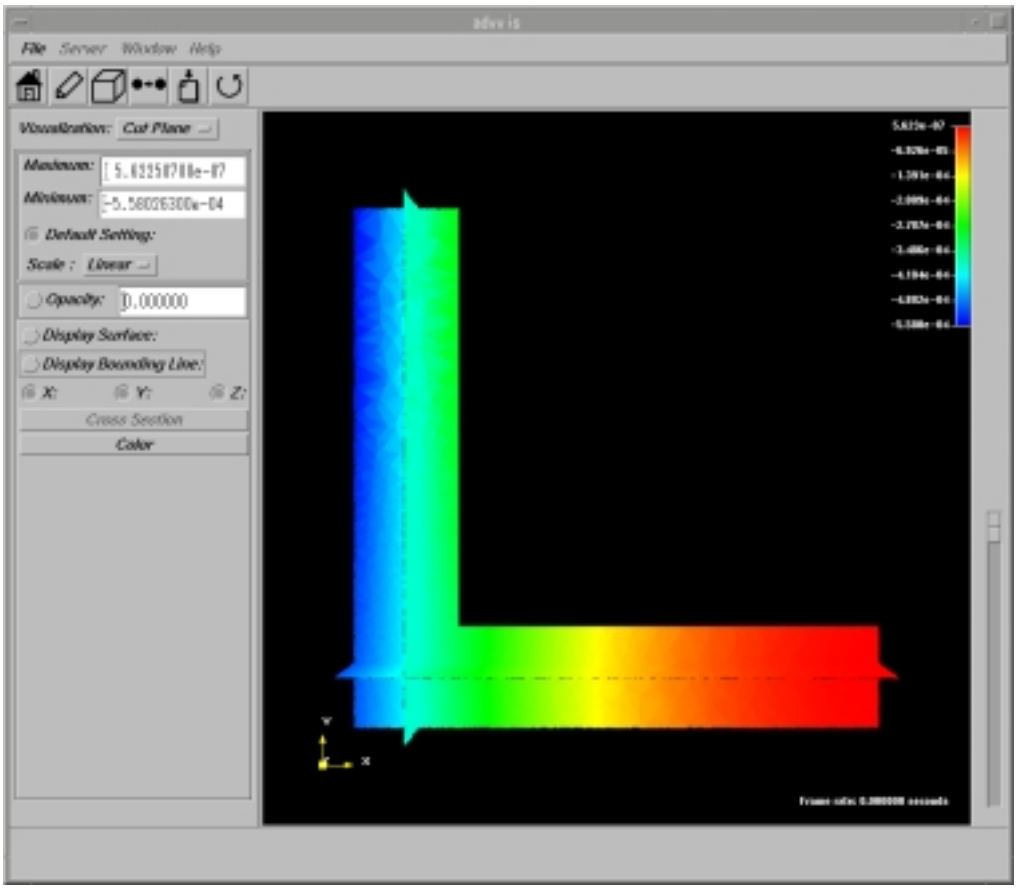

Fig. 7-26. Section Scalar Display (Bounding box is not displayed)

7. Setting a value in the ***Maximum*** and ***Minimum*** input fields of the main window can change the range of scalar and, turning off the ***Default Setting*** toggle button, the display will be changed. The scalar values more than the value set in ***Maximum*** are displayed by the red color and the scalar values below the value set in ***Minimum*** are displayed by the blue color. If the ***Default Setting*** toggle button is turned on, the scalar value set in the ***Maximum*** field will be set to the maximum value and the scalar value set in the ***Minimum*** field will be set to the minimum value.

Fig. 7-27 shows an example when the value of -0.0004 is set from the state of Fig. 7-26 in the ***Maximum*** input field and the value of -0.0003 is set in the ***Minimum*** input field.

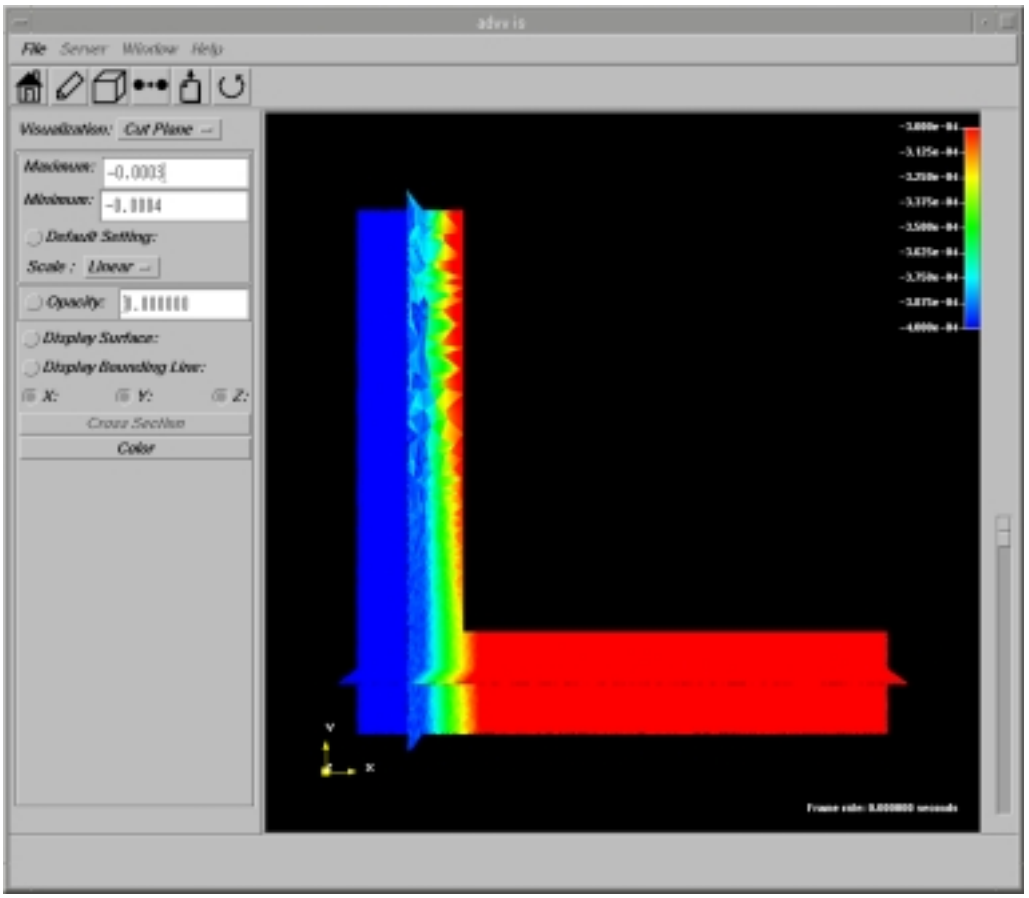

Fig. 7-27. Section Scalar Display (Maximum = -0.0003, Minimum = -0.00044)

8. The section scalar distribution, which corresponds to each of X, Y, and Z can be displayed or non-displayed by switching the ***X***, ***Y***, ***Z*** toggle buttons at the left of the main window (on and off). For example, when only the section scalar distribution that corresponds to X-axis (be horizontal to the X axis) is displayed, only the ***X*** toggle button is turned on, and the ***Y*** and ***Z*** toggle buttons are turned off.
Fig. 7-28, Fig. 7-29, and Fig. 7-30 show the example mentioned above.

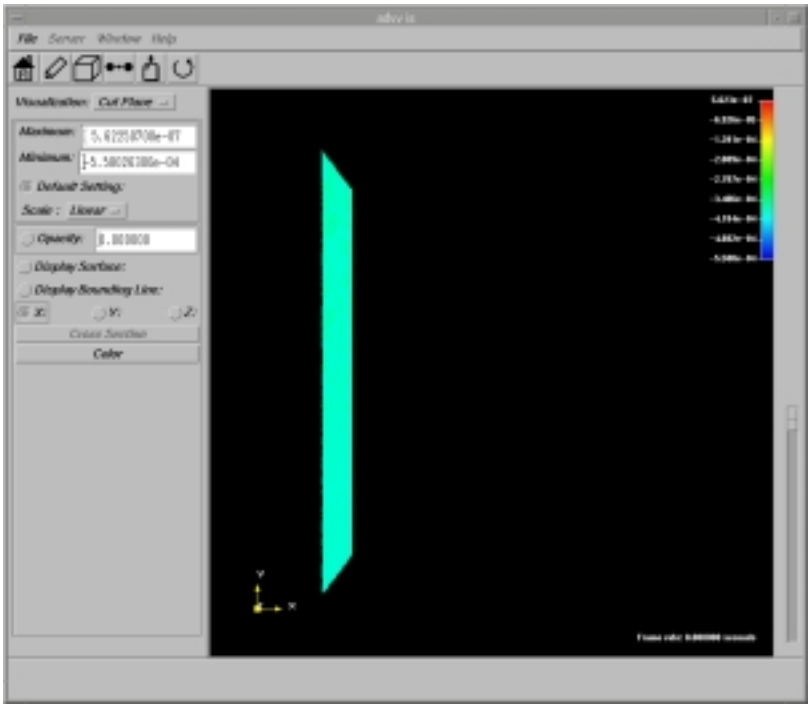

*Fig. 7-28. Section Scalar Display (only **X** is switched on)*

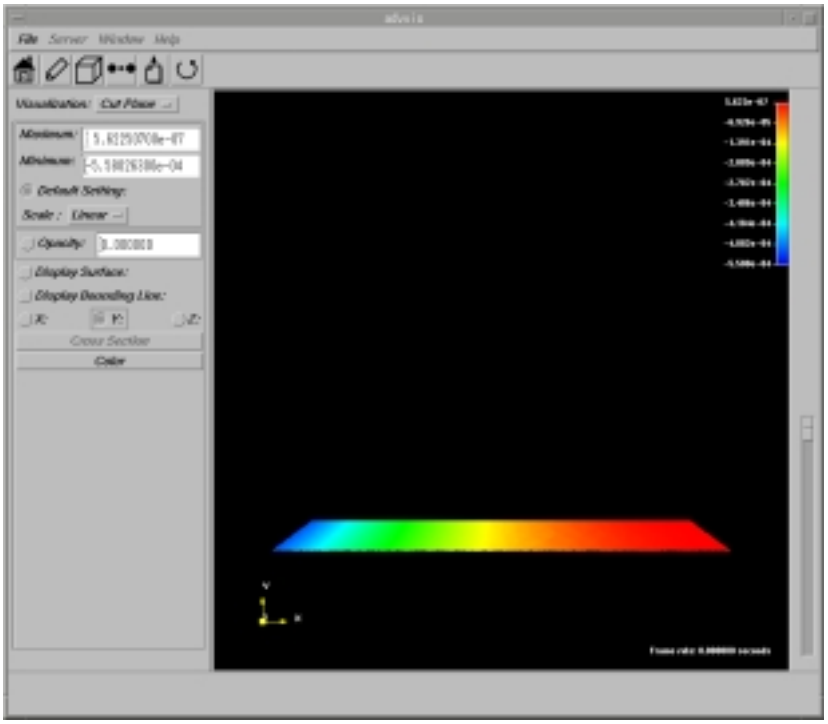

*Fig. 7-29. Section Scalar Display (only **Y** is switched on)*

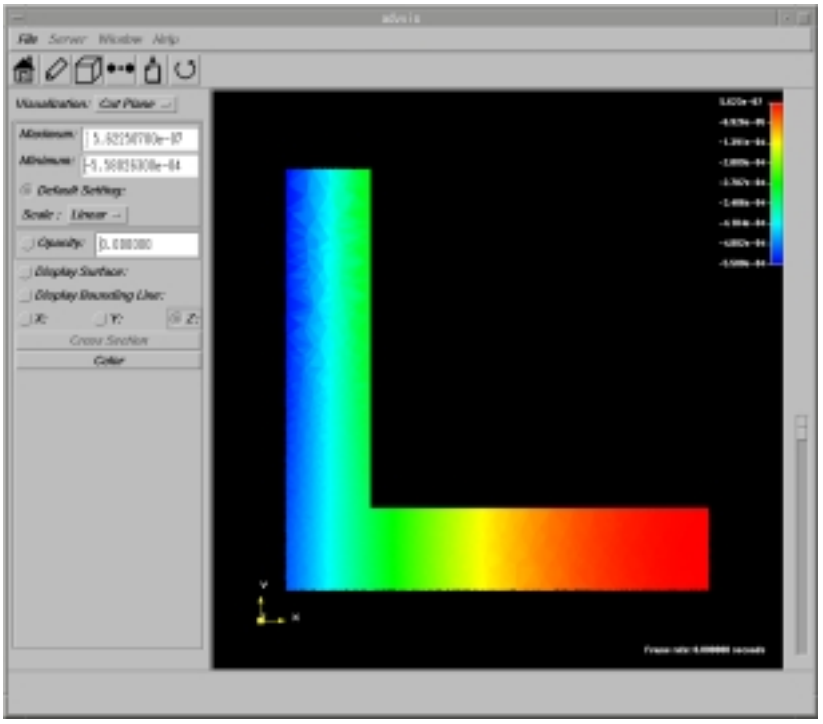

*Fig. 7-30. Section Scalar Display (only **Z** is switched on)*

7.6. Saving the Results

The results can be saved using the following procedures:

1. Select the ***Save*** option from the ***File*** menu of the main window, and the file selection dialog shown in Fig. 7-31 will be displayed.
2. Input the filename and click ***OK*** button. To cancel the file saving, click the ***Cancel*** button.
3. To display the saved results, select the option ***Read Result*** from the ***File*** menu. The file name should be specified in a similar file selection dialog window if the file was previously saved. Connection to Server is unnecessary in this case.

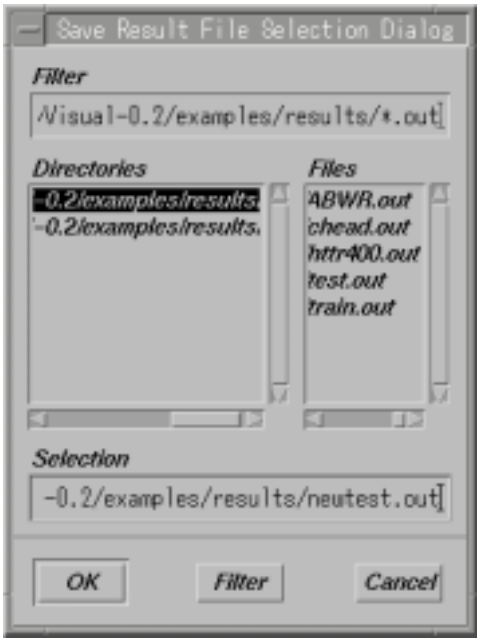

Fig. 7-31. Dialog Window for File Selection

7.7. Setting of Colors

The display color can be set selecting the button ***Color*** for ***Geometry***, ***Surface***, and ***CutPlane*** of the ***Visualization*** pop-up menu. The dialog shown Fig. 7-32 will appear.

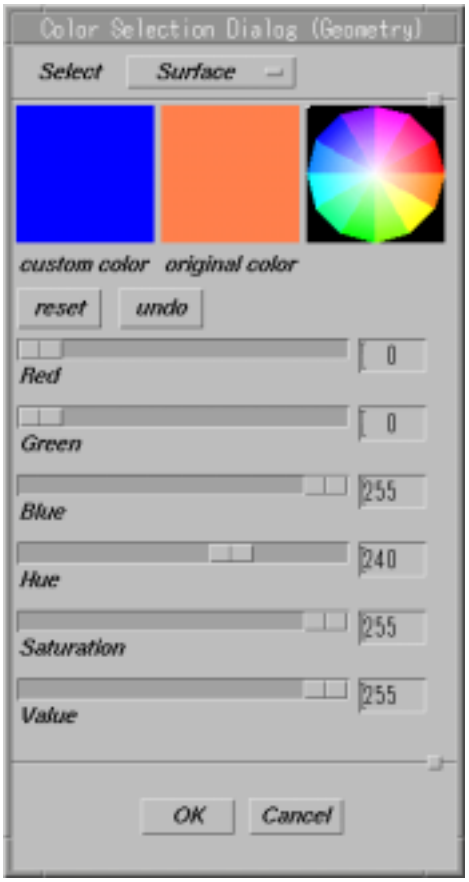

Fig. 7-32. Color Selection Dialog

An arbitrary color can be set according to **RGB** values and **HSV** values. Full-color will be displayed using computer at 24-bits. For the other cases, 8-bit display will be shown. If the display is set to 8 bit, the Value=255 is fixed in the ***HSV*** slider.

1. *Menu* ***Select***
   The table of colors of the element, the element side, and the background color, etc. is acquired at the time of displaying the dialog. The item is displayed using the selected color.

2. ***original color***
   The item ***color*** is displayed in the menu.

3. ***custom color***
   If the colors are changed by the ***RGB*** and ***HSV*** sliders, the settings are displayed in real time.

4. *Color circle display domain*
   RGB value is displayed following the ***RGB*** and ***HSV*** sliders movement. The color can be selected by a mouse click in the color circle.

5. ***Red*** *slider*
   The value of the red color can be changed. 24-bits have 256 steps (numerical value of 0-255). 8-bits have six steps.

6. ***Green*** *slider*
   The value of the green color can be changed. 24-bits have 256 steps (numerical value of 0-255). 8-bits have six steps.

7. ***Blue*** *slider*
   The value of the blue color can be changed. 24-bits have 256 steps (numerical value of 0-255). 8-bits have six steps.

8. ***Hue*** *slider*
   The hue (color and hue) in the HSV system can be changed. An integer value of 0-360 can be set.

9. ***Saturation*** *slider*
   Saturation (chrome) in the HSV system can be changed. An integer value of 0-255 can be set.

10. ***Value*** *slider*
    Brightness in the HSV system can be changed. An integer value of 0-255 can be set.

11. ***OK*** *button*
    Confirms made selections.

12. ***Cancel*** *button*
    Cancels the color selection operations and closes the dialog box.

7.8. Scaling of Image

The Scaling slider (Fig. 7-33) located on the right of the main window can be moved up and down to perform the scaling of image. The movement of the slider downwards expands the image. The movement of the slider upwards reduces the image.

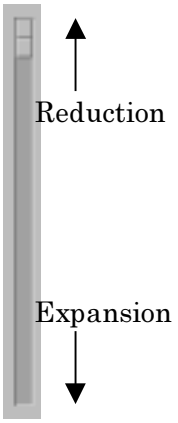

Fig. 7-33. Scaling Slider

8. System Shutdown

8.1. Server Shutdown

To shut the system down, open the Controller/Server Controller/Dialog. When the Server control dialog is displayed, and the Shutdown button in the upper part is clicked, the confirmation for shutdown is displayed. The process of complete Server shutdown starts if the ***OK*** button of the question dialog is clicked.

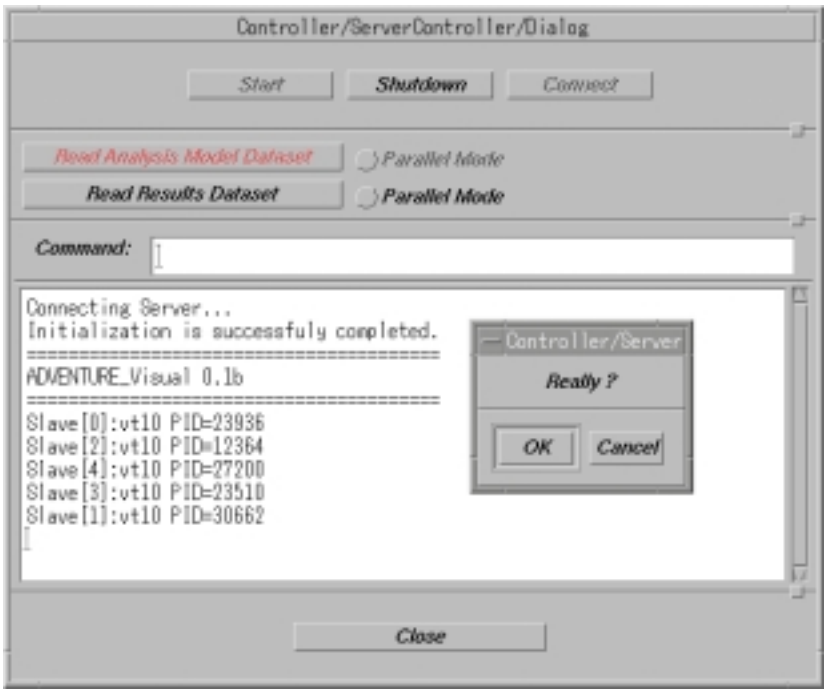

Fig. 8-1. Server Control Dialog and Confirmation Dialog

8.2. Client Shutdown

After the processes of Server shutdown and Client shutdown are finished, the item ***Quit*** should be selected from the ***File*** menu of the main window.