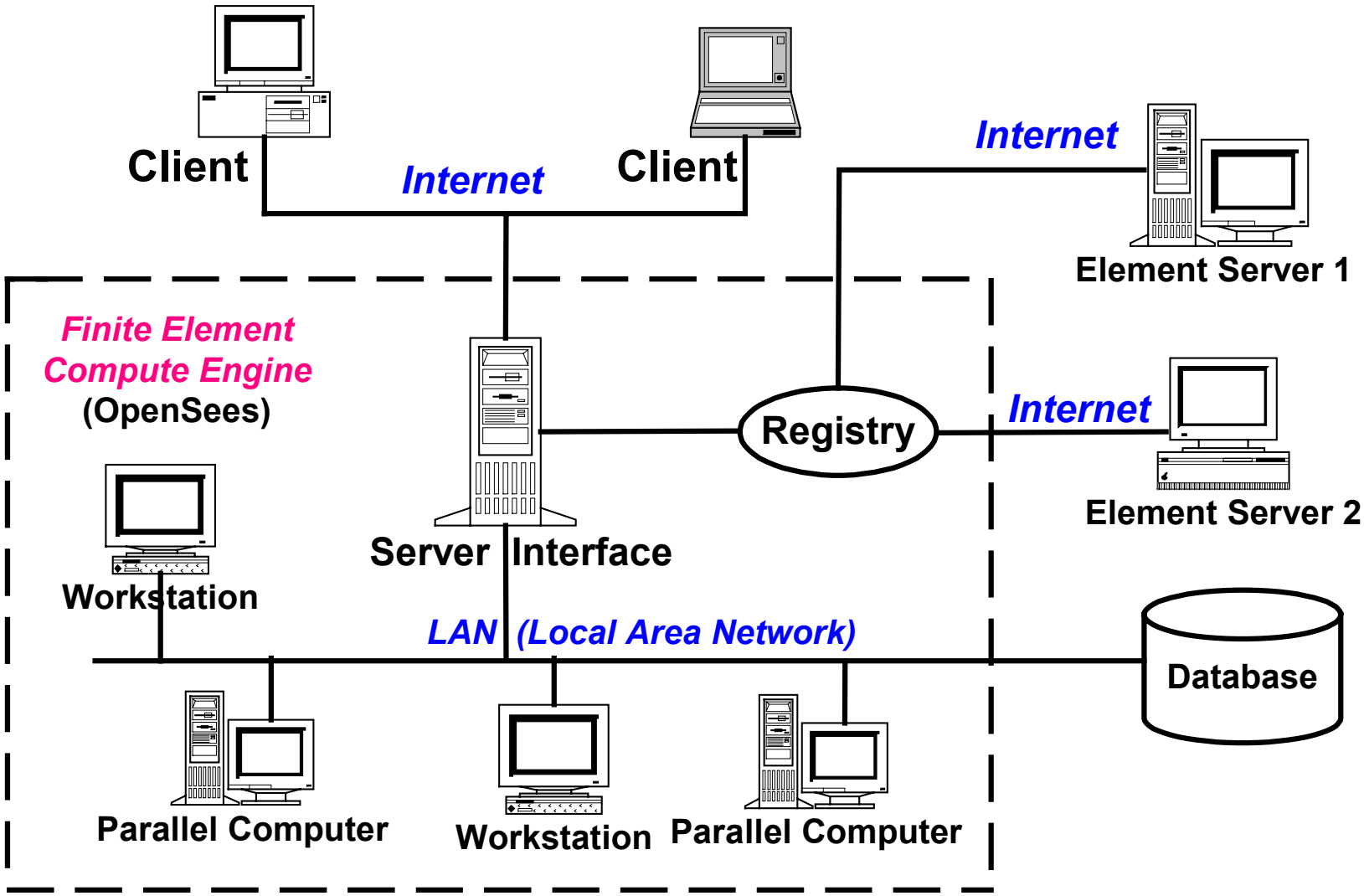
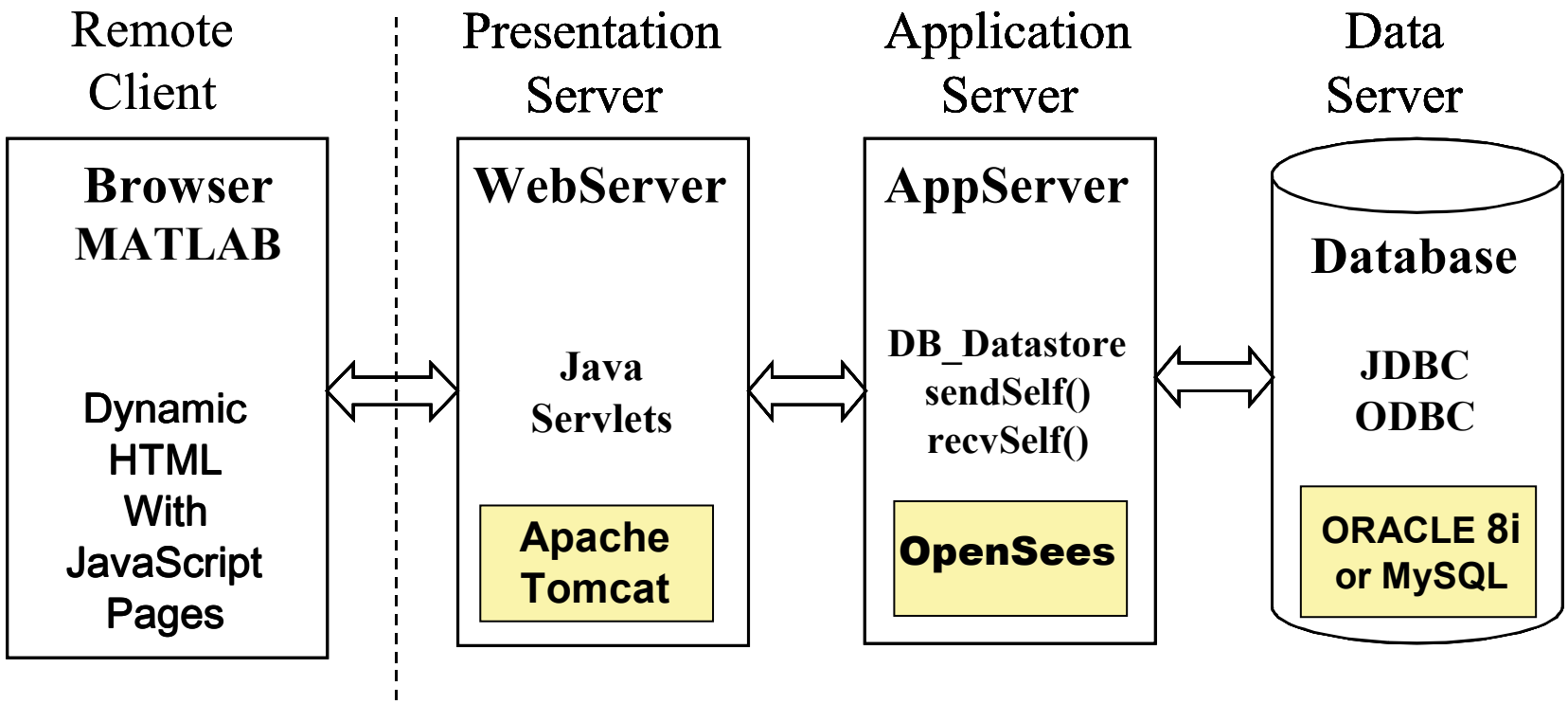
List of Figures

List of Tables

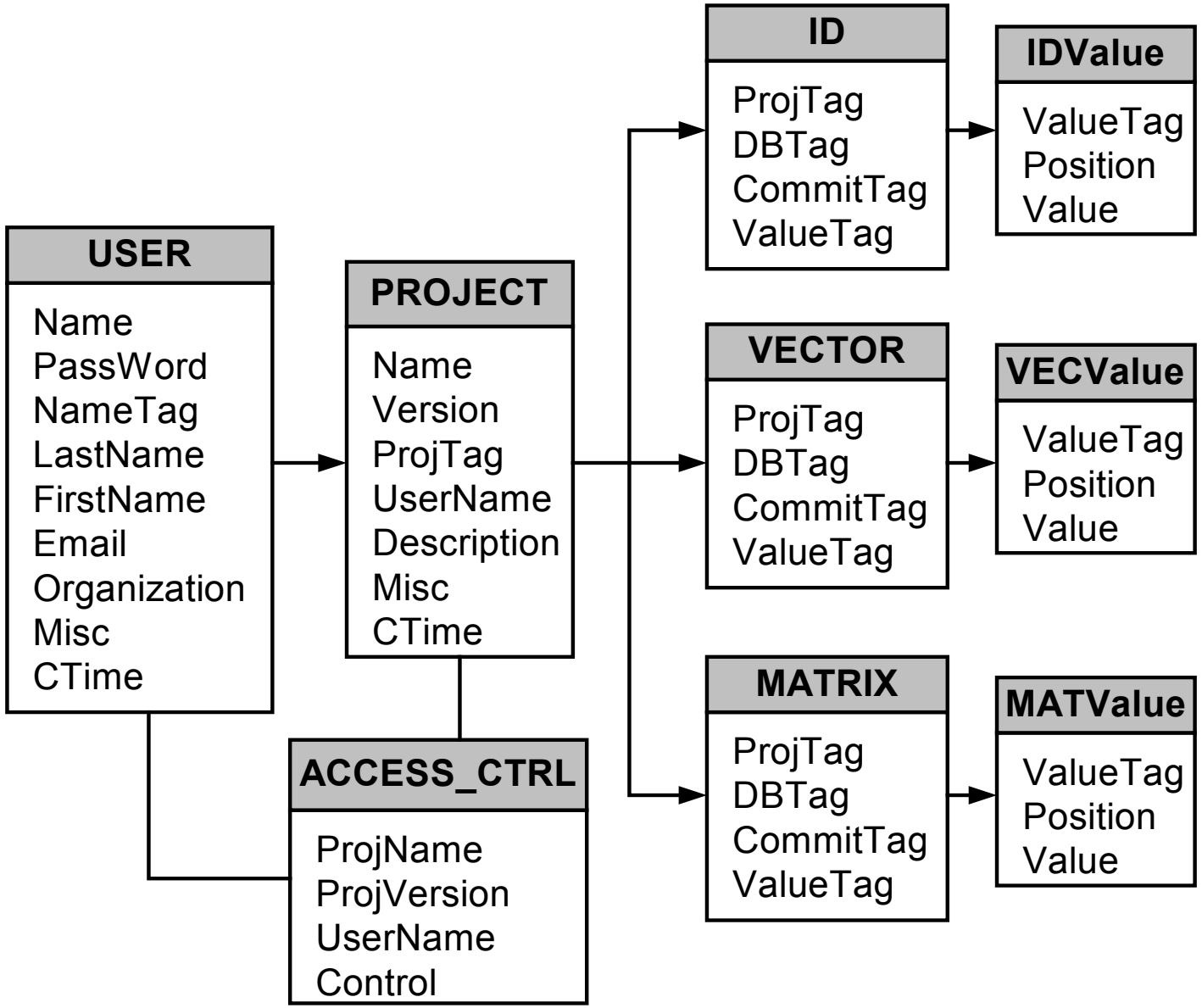

Client
Internet
Client
Internet
Element Server 1
Finite Element
Compute Engine
(OpenSees)
Registry
Internet
Element Server 2
Server Interface
Workstation
LAN (Local Area Network)
Database
Parallel Computer
Workstation
Parallel Computer


Remote Client
Presentation Server
Application Server
Data Server
Browser
MATLAB
Dynamic HTML With JavaScript Pages
WebServer
Java Servlets
Apache Tomcat
AppServer
DB_Datastore
sendSelf()
recvSelf()
OpenSees
Database
JDBC
ODBC
ORACLE 8i or MySQL

```
class DB_Datastore {
   DB_Datastore(char* dbName, Domain &theDomain,
                FEM_ObjectBroker &broker);
   ~DB_Datastore();

   // method to get a database tag.
   int getDbTag(void);
   // methods to set and get a project tag.
   int getProjTag();
   void setProjTag(int projectTag);

   virtual int sendObj(int commitTag, MovableObject &theObject,
           ChannelAddress *theAddress);
   virtual int recvObj(int commitTag, MovableObject &theObject,
           FEM_ObjectBroker &theBroker, ChannelAddress *theAddress);

   virtual int sendMatrix(int dbTag, int commitTag,
           const Matrix &theMatrix, ChannelAddress *theAddress);
   virtual int recvMatrix(int dbTag, int commitTag,
           Matrix &theMatrix, ChannelAddress *theAddress);

   virtual int sendVector(int dbTag, int commitTag,
           const Vector &theVector, ChannelAddress *theAddress);
   virtual int recvVector(int dbTag, int commitTag,
           Vector &theVector, ChannelAddress *theAddress);

   virtual int sendID(int dbTag, int commitTag,
           const ID &theID, ChannelAddress *theAddress);
   virtual int recvID(int dbTag, int commitTag,
           ID &theID, ChannelAddress *theAddress);
}
```

```
Domain::recvSelf(int savedStep, Channel &database,
                 FEM_ObjectBroker &theBroker)
{
   // First we receive the data regarding the state of the Domain.
   ID domainData(this->DOMAIN_SIZE);
   database.recvID(this->INIT_DB_TAG, savedStep, domainData);

   // We can restore Nodes based on saved information.
   int numNodes = domainData(this->NODE_INDEX);
   int nodeDBTag = domainData(this->NODE_DB_TAG);

   // Receive the data regarding type and dbTag of the Nodes.
   ID nodesData(2*numNodes);
   database.recvID(nodeDBTag, savedStep, nodesData);

   for (i = 0; i < numNodes; i++) {
      int classTagNode = nodeData(2*i);
      int dbTagNode = nodeData(2*i+1);
      // Create a template of the Node based on its classTag.
      MovableObject *theNode = theBroker.getPtrObject(classTagNode);
      // The Node itself tries to restore its state.
      theNode->recvSelf(savedStep, database, theBroker);
      // Add this Node to be a component of the Domain.
      this->addNode(theNode);
   }

   // Same as Nodes above, we rebuild Elements, Constraints, and Load
   ...
}
```

```
Domain* convertToState(int requestStep, char* dbName, double convergenceTest)
{
   Domain* theDomain = new Domain();
   FEM_OjbectBroker *theBroker = new FEM_ObjectBroker();
   DB_Datastore *database = new DB_Datastore(dbName, *theDomain, *theBroker);

   // Find the sampled largest time step that is <= requestStep.
   int savedStep = findMiniMax(*database, requestStep);

   // The domain restores itself to the state of savedStep.
   theDomain->recvSelf(savedStep, *database, *theBroker);

   // The first parameter is dLamda, the second is numIncrements.
   Integrator *theIntegrator = new LoadControl(0.1, 10);
   SolutionAlgorithm *theAlgorithm = new NewtonRaphson(convergenceTest);

   // Set the links to theAlgorithm with theDomain and theIntegrator.
   theAlgorithm->setLinks(theDomain, theIntegrator);

   // Progress the state of theDomain to the requestStep.
   for (int i = savedStep, i < requestStep; i++) {
       theIntegrator->newStep();
       theAlgorithm->solveCurrentStep();
       theIntegrator->commit();
   }

   return *theDomain;
}
```


USER
Name
PassWord
NameTag
LastName
FirstName
Email
Organization
Misc
CTime
PROJECT
Name
Version
ProjTag
UserName
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Misc
CTime
ACCESS_CTRL
ProjName
ProjVersion
UserName
Control
ID
ProjTag
DBTag
CommitTag
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IDValue
ValueTag
Position
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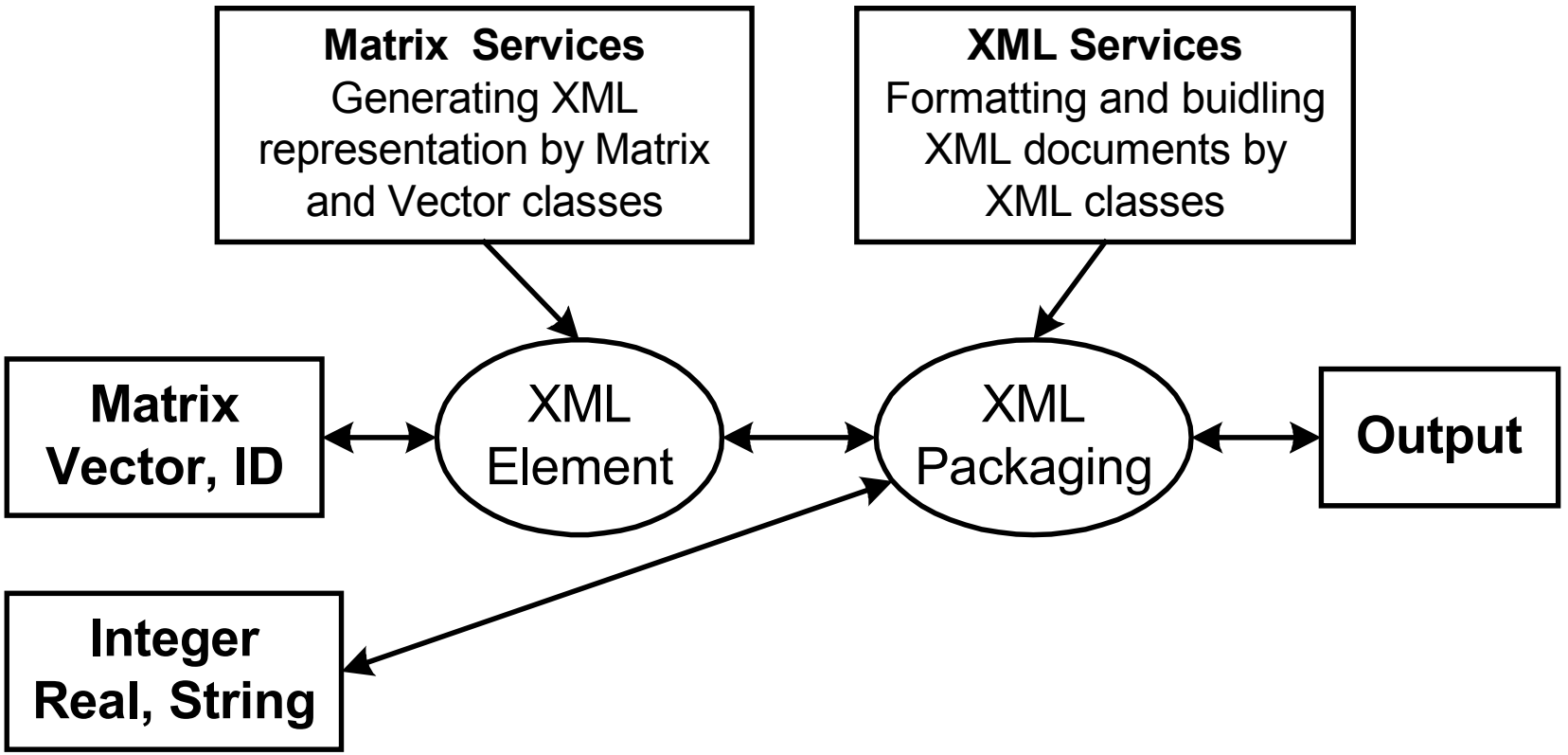
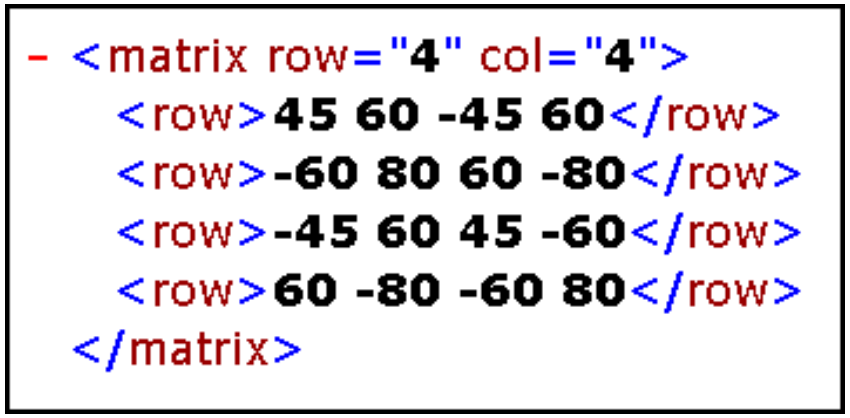
VECTOR
ProjTag
DBTag
CommitTag
ValueTag
VECValue
ValueTag
Position
Value
MATRIX
ProjTag
DBTag
CommitTag
ValueTag
MATValue
ValueTag
Position
Value


Matrix Services
Generating XML representation by Matrix and Vector classes
XML Services
Formatting and buidling XML documents by XML classes
Matrix
Vector, ID
XML
Element
XML
Packaging
Output
Integer
Real, String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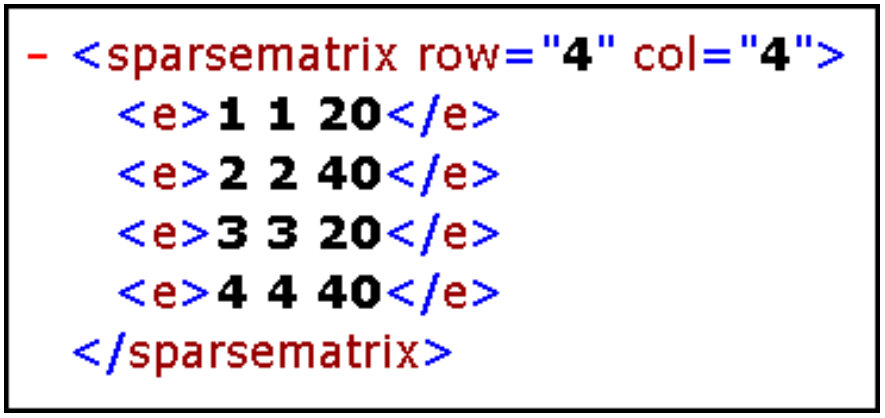
</matrix>

(a)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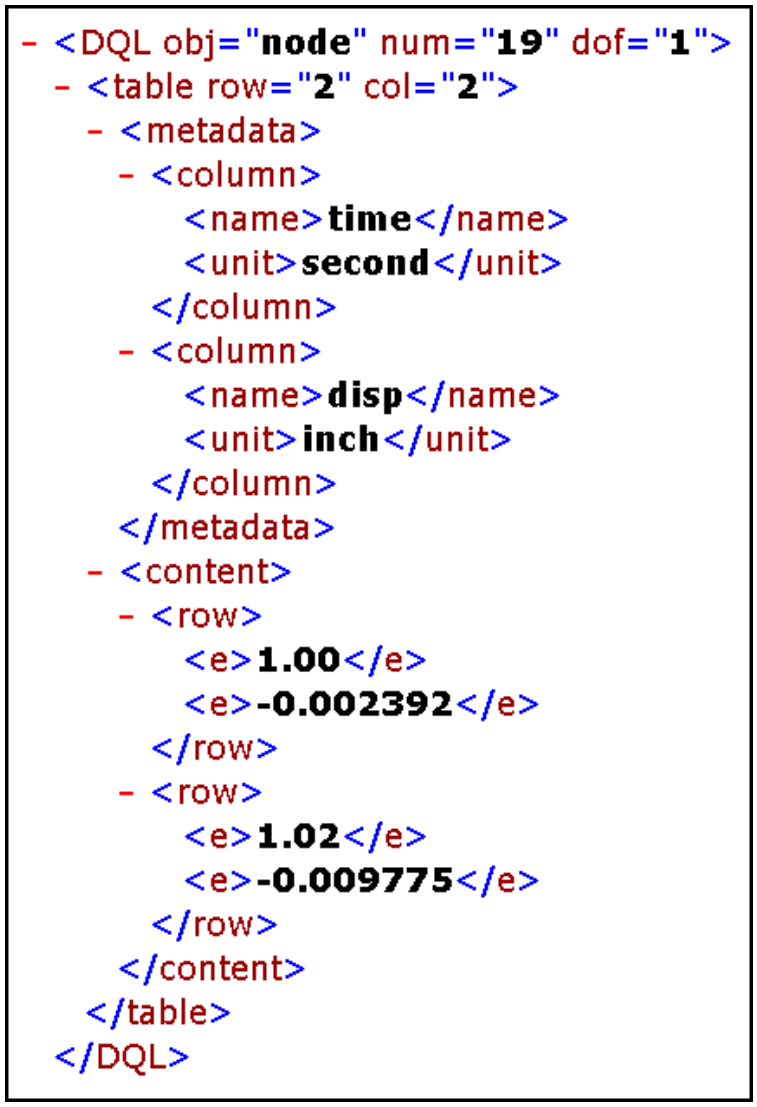
<e>2 2 40</e>
<e>3 3 20</e>
<e>4 4 40</e>
</sparsematrix>

(b)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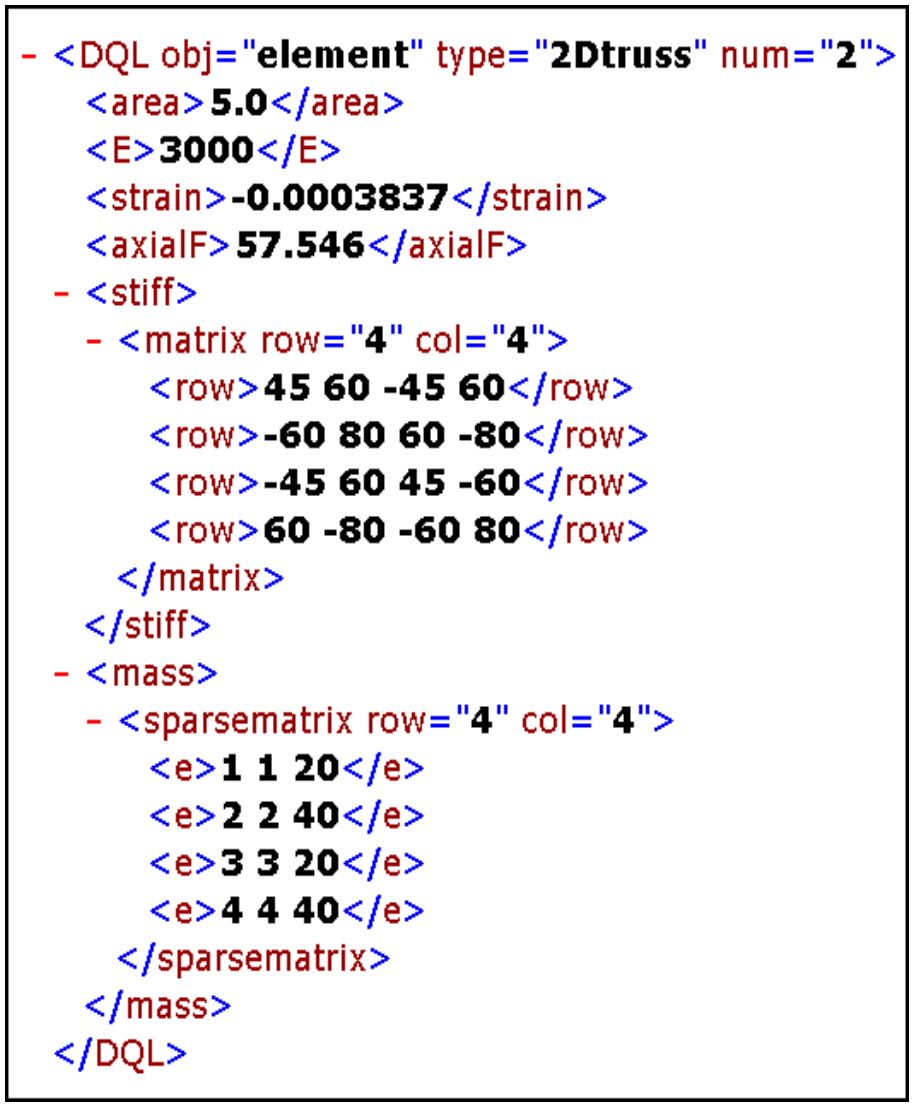
(a)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- <stiff>
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</stiff>
- <mass>
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<e>2 2 40</e>
<e>3 3 20</e>
<e>4 4 40</e>
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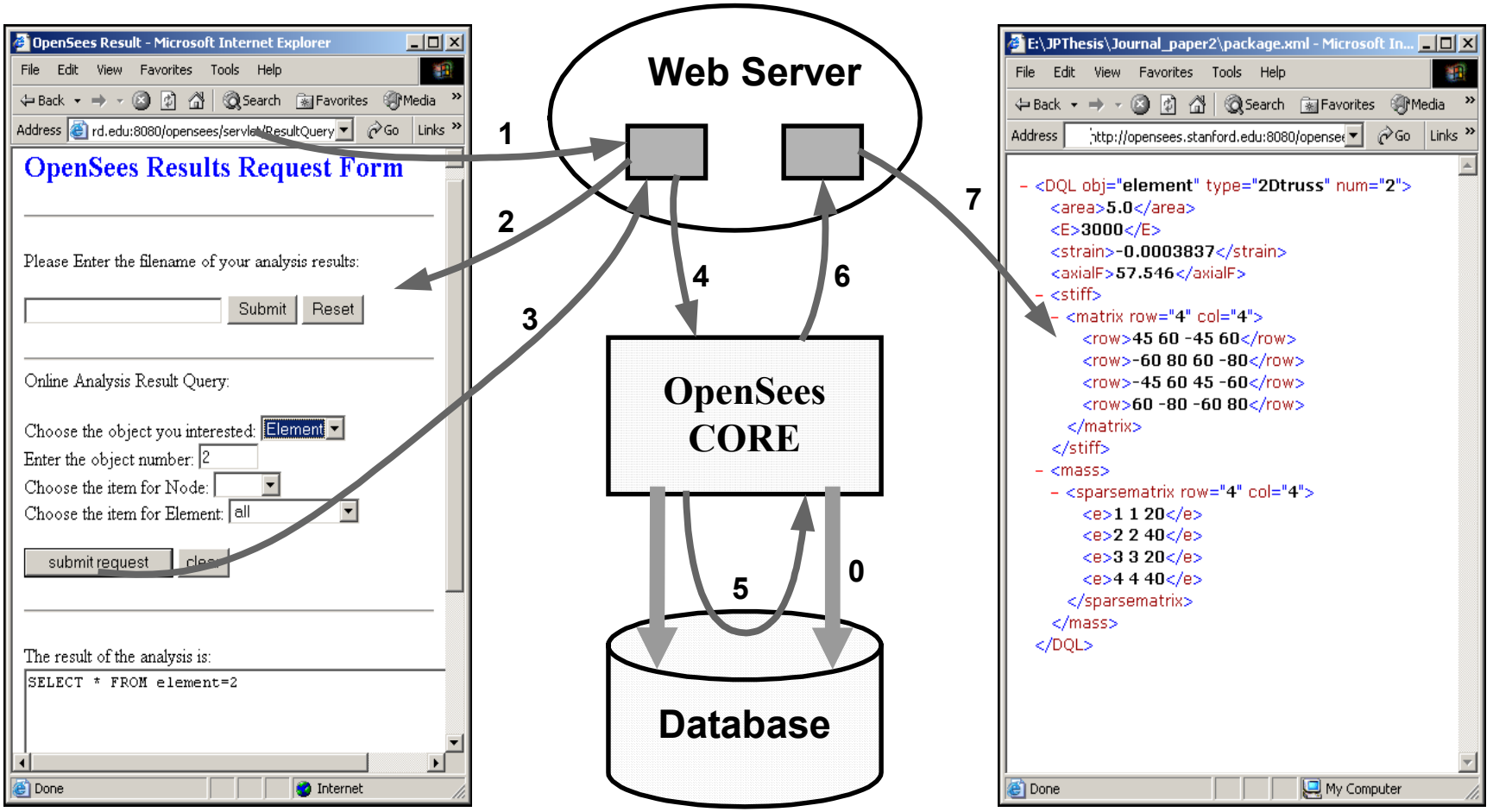
</mass>
</DQL>

(b)


OpenSees Result - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address rd.edu:8080/opensees/servlet/ResultQuery
Go Links
OpenSees Results Request Form
Please Enter the filename of your analysis results:
Submit
Reset
Online Analysis Result Query:
Choose the object you interested: Element
Enter the object number: 2
Choose the item for Node:
Choose the item for Element: all
submit request
clear
The result of the analysis is:
SELECT * FROM element=2
Done
Internet
Web Server
OpenSees CORE
Database
1
2
3
4
5
6
7
0
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File Edit View Favorites Tools Help
Back Search Favorites Media
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Go Links
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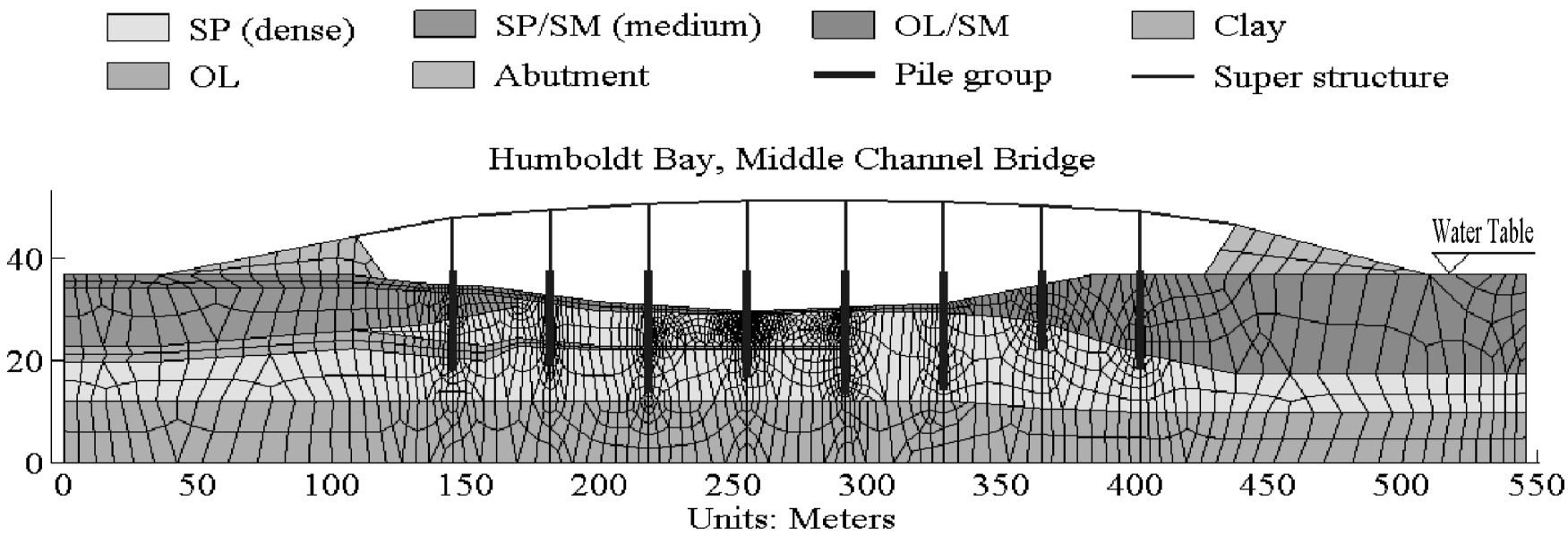
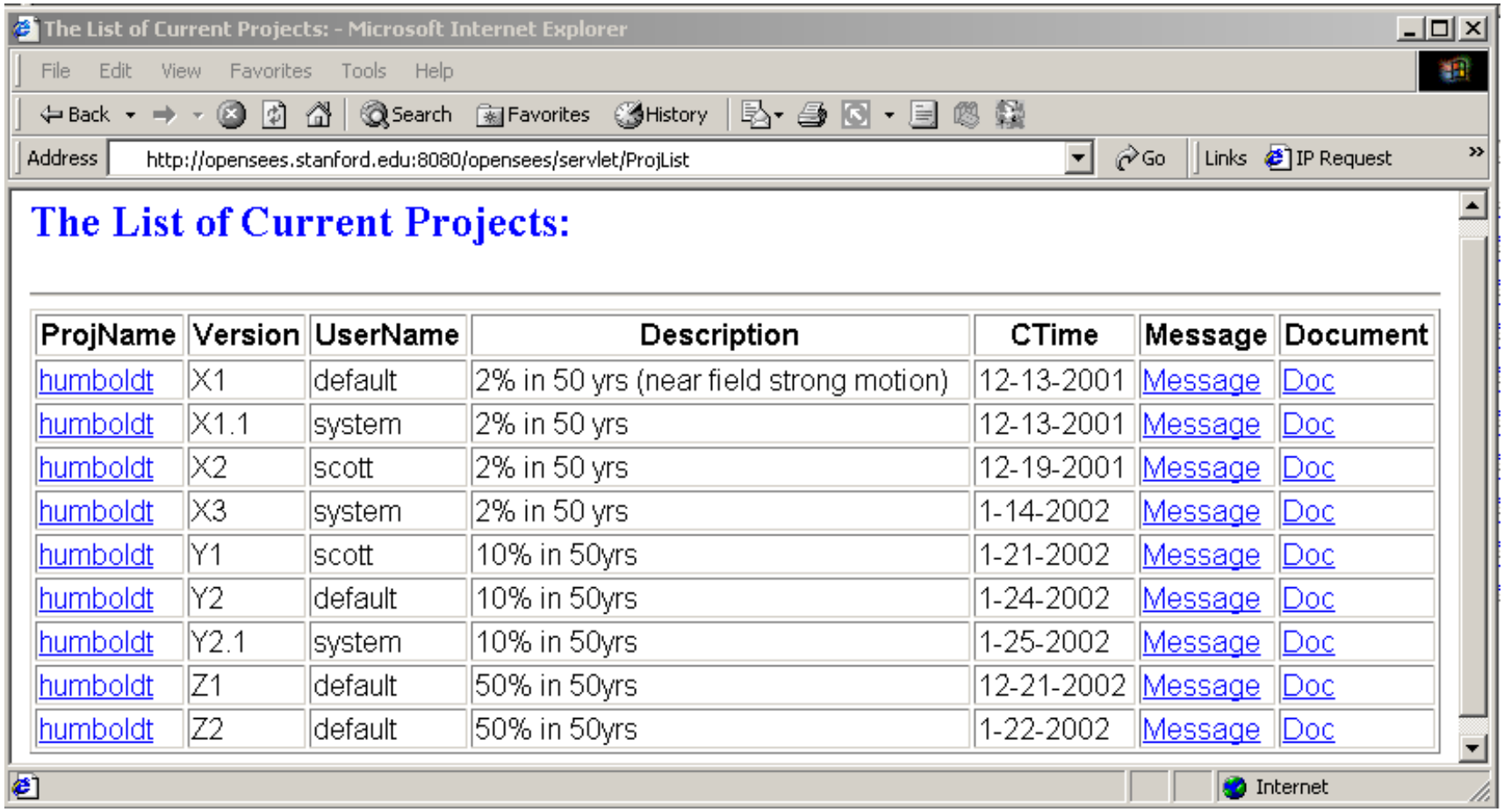
Done
My Computer


SP (dense)
SP/SM (medium)
OL/SM
Clay
OL
Abutment
Pile group
Super structure
Humboldt Bay, Middle Channel Bridge
Water Table
40
20
0
0
50
100
150
200
250
300
350
400
450
500
550
Units: Meters



The List of Current Projects:

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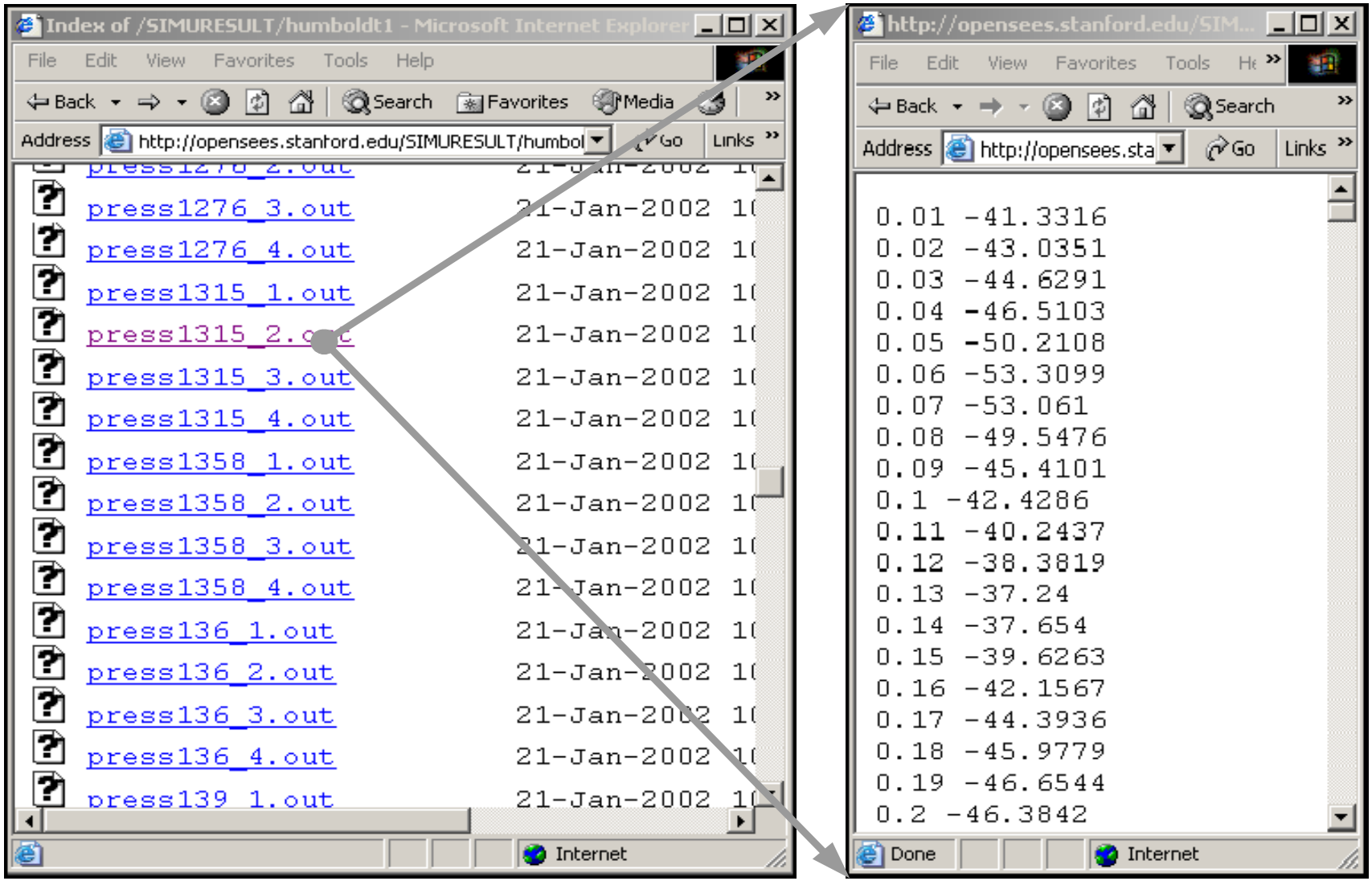
humboldt	X1.1	system	2% in 50 yrs	12-13-2001	Message	Doc
humboldt	X2	scott	2% in 50 yrs	12-19-2001	Message	Doc
humboldt	X3	system	2% in 50 yrs	1-14-2002	Message	Doc
humboldt	Y1	scott	10% in 50yrs	1-21-2002	Message	Doc
humboldt	Y2	default	10% in 50yrs	1-24-2002	Message	Doc
humboldt	Y2.1	system	10% in 50yrs	1-25-2002	Message	Doc
humboldt	Z1	default	50% in 50yrs	12-21-2002	Message	Doc
humboldt	Z2	default	50% in 50yrs	1-22-2002	Message	Doc


Index of /SIMURESULT/humboldt1 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://opensees.stanford.edu/SIMURESULT/humbol
Go Links
press1276_3.out 21-Jan-2002 1
press1276_4.out 21-Jan-2002 1
press1315_1.out 21-Jan-2002 1
press1315_2.out 21-Jan-2002 1
press1315_3.out 21-Jan-2002 1
press1315_4.out 21-Jan-2002 1
press1358_1.out 21-Jan-2002 1
press1358_2.out 21-Jan-2002 1
press1358_3.out 21-Jan-2002 1
press1358_4.out 21-Jan-2002 1
press136_1.out 21-Jan-2002 1
press136_2.out 21-Jan-2002 1
press136_3.out 21-Jan-2002 1
press136_4.out 21-Jan-2002 1
press139_1.out 21-Jan-2002 1
Internet
http://opensees.stanford.edu/SIM...
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Back Search
Address http://opensees.sta
Go Links
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0.02 -43.0351
0.03 -44.6291
0.04 -46.5103
0.05 -50.2108
0.06 -53.3099
0.07 -53.061
0.08 -49.5476
0.09 -45.4101
0.1 -42.4286
0.11 -40.2437
0.12 -38.3819
0.13 -37.24
0.14 -37.654
0.15 -39.6263
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0.2 -46.3842
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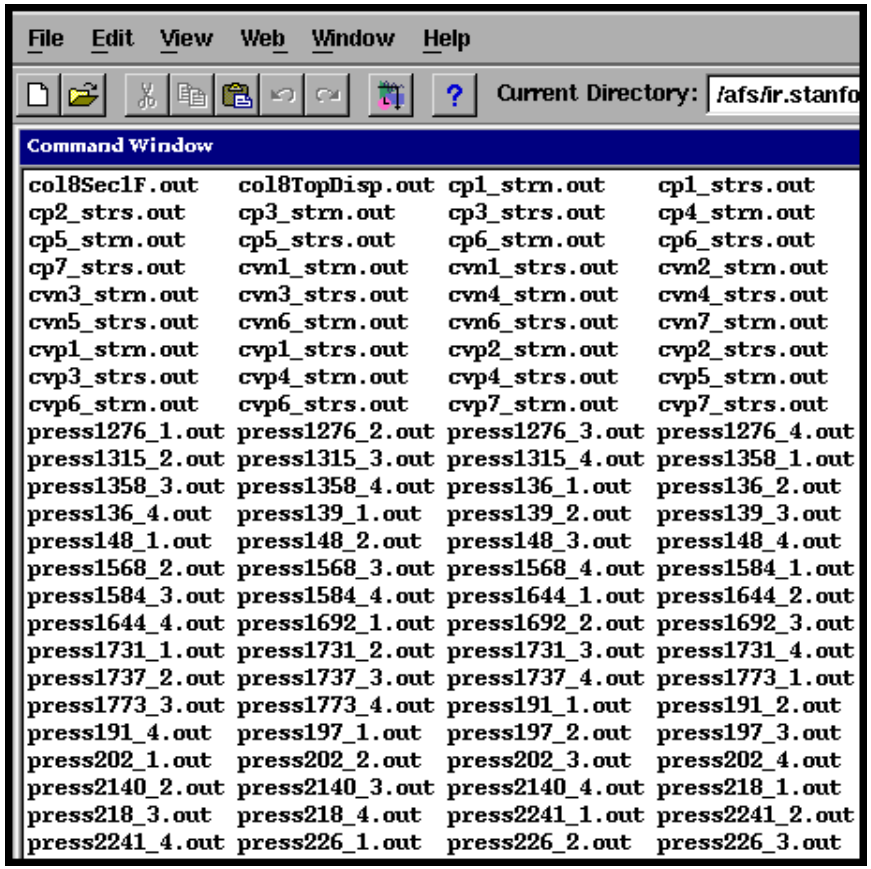
Internet


File Edit View Web Window Help
Current Directory: /afs/ir.stanfo
Command Window
col8Sec1F.out col8TopDisp.out cp1_strn.out cp1_strs.out
cp2_strs.out cp3_strn.out cp3_strs.out cp4_strn.out
cp5_strn.out cp5_strs.out cp6_strn.out cp6_strs.out
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press1315_2.out press1315_3.out press1315_4.out press1358_1.out
press1358_3.out press1358_4.out press136_1.out press136_2.out
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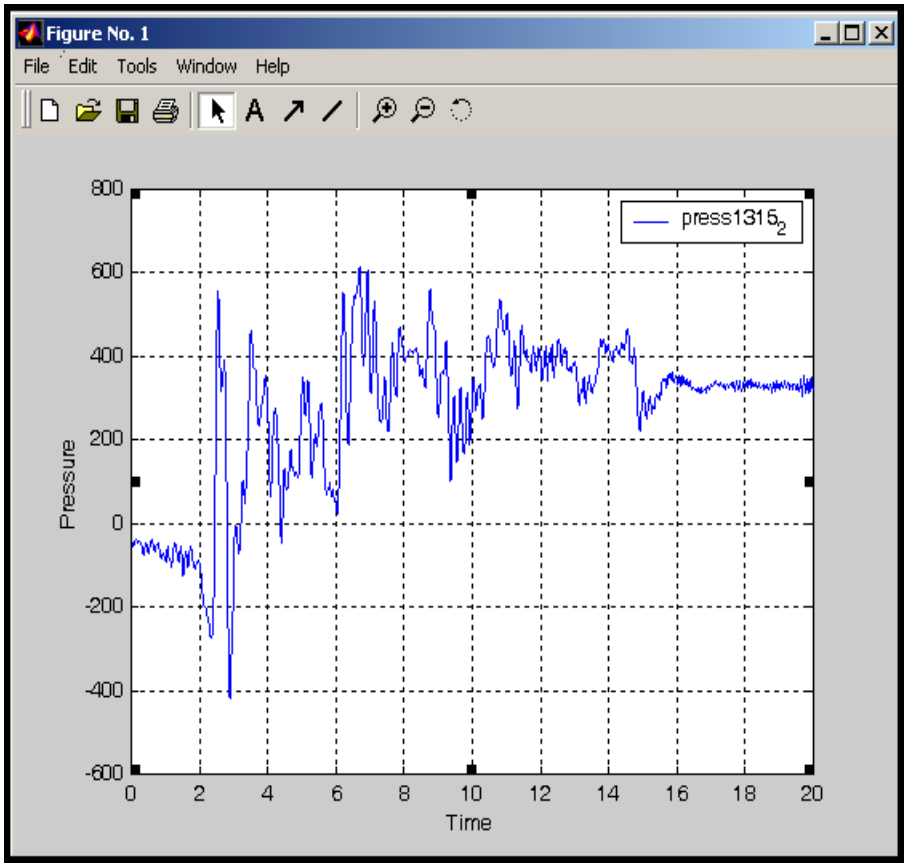
(a)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File Edit Tools Window Help
press1315_2
Pressure
Time
800
600
400
200
0
-200
-400
-600
0 2 4 6 8 10 12 14 16 18 20

(b)

Time Steps	Analysis Time (mins)	Analysis Time (mins) (With Database)	Analysis Time (mins) (With Files)
100	262.6	321.6	314.5
500	1249.4	1663.8	1701.1
600	1437.3	1914.3	2026.7

Table 1. Solution time (in minutes) for nonlinear dynamic analysis

Time Steps	Analysis Time (mins)	Re-analysis Time (mins) (With Database)	Re-analysis Time (mins) (With Files)
105	281.7	39.4	46.9
539	1309.5	67.9	85.6
612	1464.8	55.7	71.4

Table 2. Solution time (in minutes) for re-computation based on data storage