

Working with Engineering Applications in ...

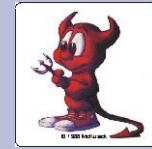


FreeBSD

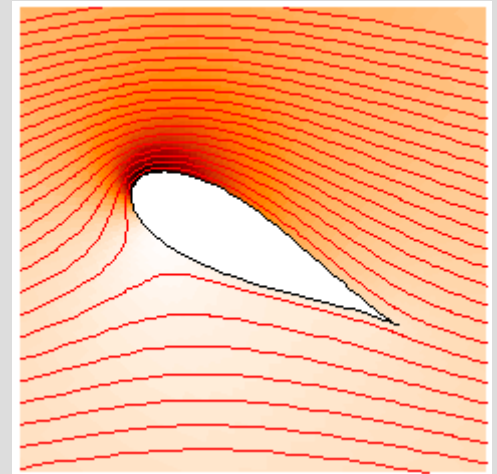


Pedro F. Giffuni M. Sc.

First “Era”

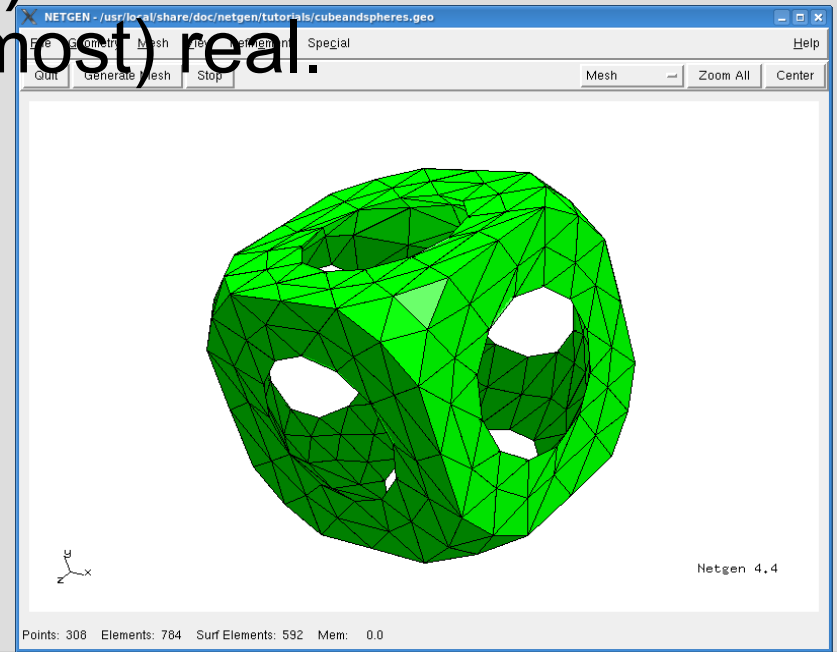
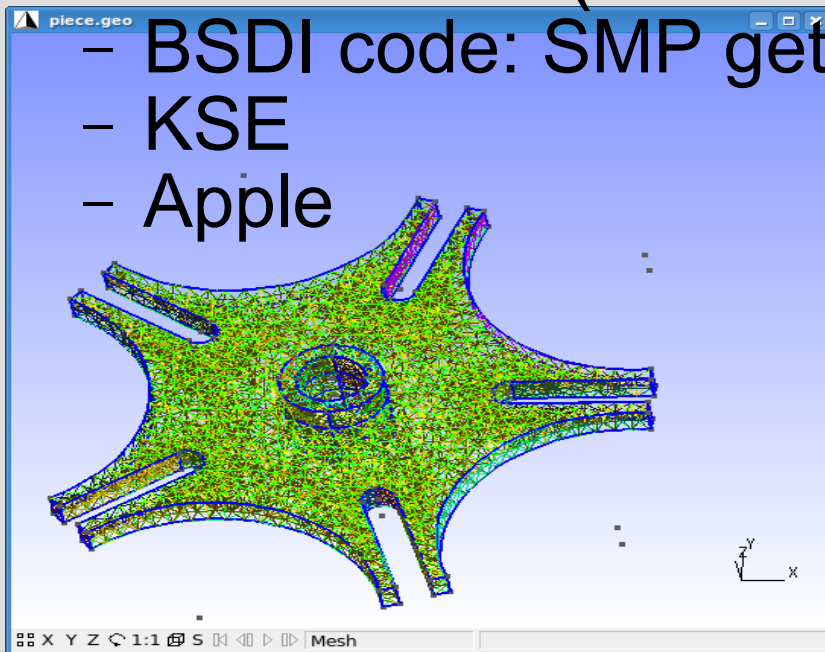


- FreeBSD 2.x (1995-1998)
 - Exceptional VM
 - Fully functional OS in 1 floppy
 - FPE exception handling $X/0 = \text{Oops}$
 - Scilab, yorick
 - SPICE, “Classic” Matlab
 - Felt
- FreeBSD 3.x (1998-2000)
 - Initial SMP + ELF - a.out was faster
 - BSDI + Linux emulation: Mathematica, Matlab
 - math ports grow.



Second Era

- FreeBSD 4.x (2000-2005)
 - Probably the most successful BSD.
 - 64-bit Alpha.
 - Major ports done
- FreeBSD 5.x (2003-2006)
 - BSDI code: SMP gets (almost) real.
 - KSE
 - Apple



So .. why *BSD again

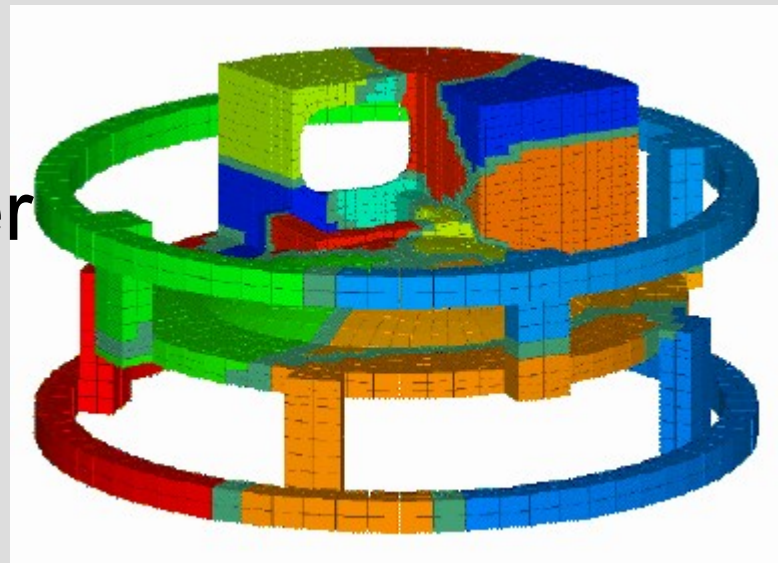
- If it works so well elsewhere, why not in math/engineering ?
- Stability, consistency, portability, the license, and other BSD characteristics.
- CPUs stopped growing speedwise: now what?
- SMP vs Clustering
- Do I really own my technology?
- Extended vs Double precision.

What was needed

- Real SMP
- Thread aware malloc: jemalloc and benchmarks.
- Faster libm?
- Really Fast BLAS

What was done

- Threads: ptmalloc2, ptmalloc3, libumem, jemalloc per-thread caches?
- Libm enhancements.
- Ports enhancements: regression testing.
- BLAS, ATLAS, GotoBLAS, MUMPS.
- BIG packages
- ngspice, jspice
- CalculiX, Code Aster



How BIG companies REALLY work

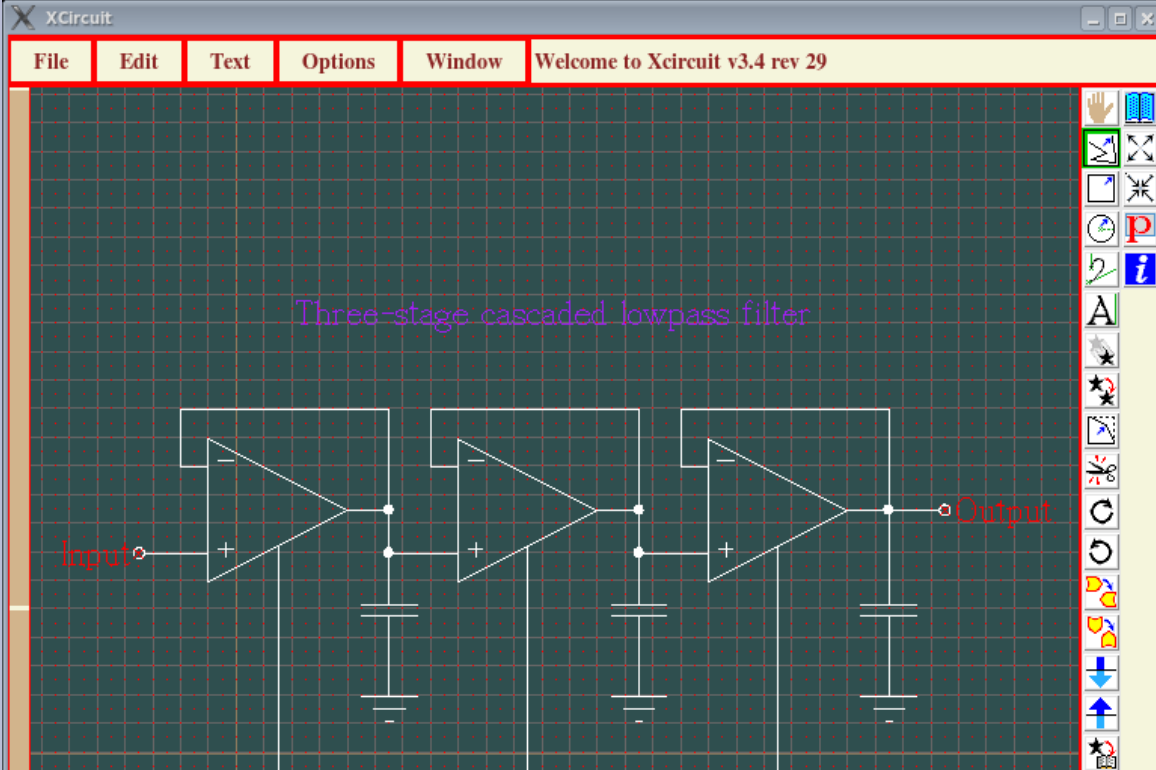
- Depending on the size of the company: change can be difficult or **VERY** difficult.
- Big companies
 - Cost doesn't really matter too much.
 - Decisions take time, plus we wait until the technology “settles”
 - Evolution not Revolution.
 - Support is critical.
 - You are on your own.

How SMALL companies REALLY work

- Small companies
 - Decisions cost money. So we wait until the technology “settles”.
 - Evolution restricted to a niche.
 - If no one has noticed it's broken, your job may depend on getting it fixed before they notice.
 - Laptop on an oil barrel policy.
 - You are on your own.

The development process

- Electrical Part
 - Input, Output, Blackbox Approach
 - Microcontrollers, amplifiers, IC's, PLCs.
- Mechanical Part
 - Solid Modelling: Standard pieces
 - Analysis: Static, Dynamic, Fatigue
- It is always **way** more complex than you thought.
- Tools you have/tools you need. Formats?
- Budget: can I get something back?



```
ltra_1.cir (read only) - /usr/ports/cad/spice/work/spice3f5/examples/
File Edit Search Preferences Shell Macro Windows Help
ltra_1.cir mixdisto.cir mos6inv.cir mosamp2.cir mosmem.cir

BJTdriver -- 24inch lossy line -- DiodeCircuit

* This unclassified circuit is from Raytheon, courtesy Gerry Marino.
* It consists of a BJT driver connected by a 24 inch lossy line to a
* passive load consisting mostly of diodes. Each inch
* of the lossy line is modelled by 10 LRC lumps in the Raytheon
* model.

* The line parameters (derived from the Raytheon input file) are:
* L = 9.13nH per inch
* C = 3.65pF per inch
* R = 0.2 ohms per inch

* the circuit
*tran 0.1ns 60ns 0 0.5ns

v1 1 0 0v pulse(0 4 1ns 1ns 1ns 20ns 40ns)
*v1 1 0 4v pulse(4 0 1ns 1ns 1ns 20ns 40ns)
vcc 10 0 5v
*rseries 1 2 5
x1 1 2 10 bjtdrv
*t1 2 0 3 0 z0=50.0136 td=4.38119ns rel=10
```

```
login <4>
Date built: Wed Oct 1 00:43:12 COT 2008

Type "help" for more information, "quit" to leave.

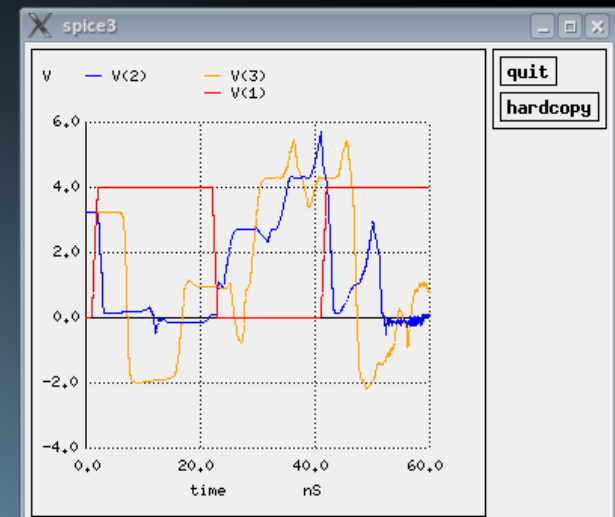
Loading raw data file ("ltra_1.raw") . . . done.
Title: BJTdriver -- 24inch lossy line -- DiodeCircuit
Name: Transient Analysis
Date: Wed Oct 1 01:15:18 2008

nutmeg 1 -> display
Here are the vectors currently active:

Title: BJTdriver -- 24inch lossy line -- DiodeCircuit
Name: tran1 (Transient Analysis)
Date: Wed Oct 1 01:15:18 2008

V(1) : voltage, real, 1891 long
V(2) : voltage, real, 1891 long
V(3) : voltage, real, 1891 long
time : time, real, 1891 long [default scale]

nutmeg 2 -> plot V1 v2 v3
Error: no such vector V1
nutmeg 3 -> plot V(1) V(2) V(3)
nutmeg 4 ->
```



Wire Mode Edit

monday93
adaptati...
2005.pdf

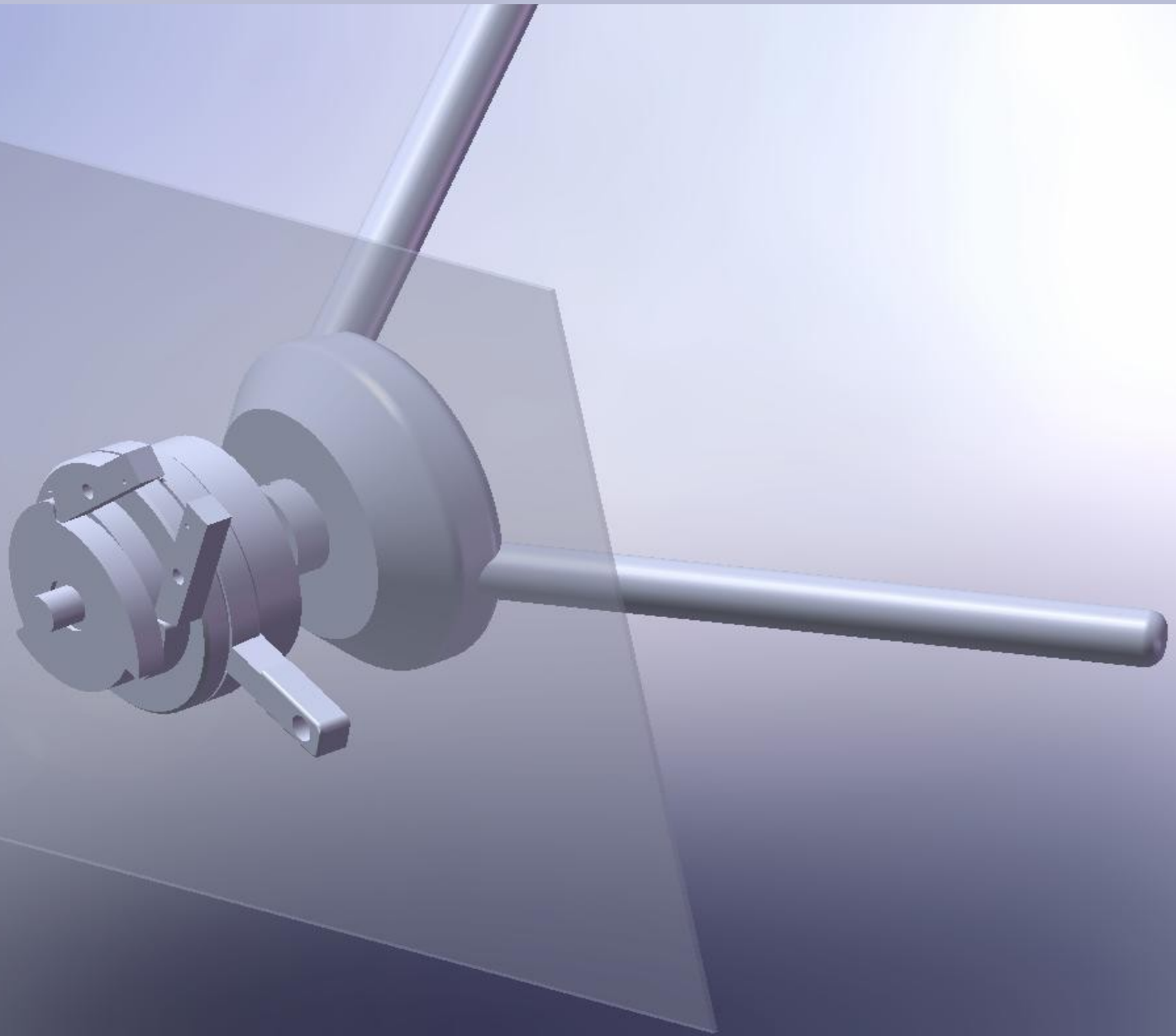
practical-
file-syst...

pfg_
resume....

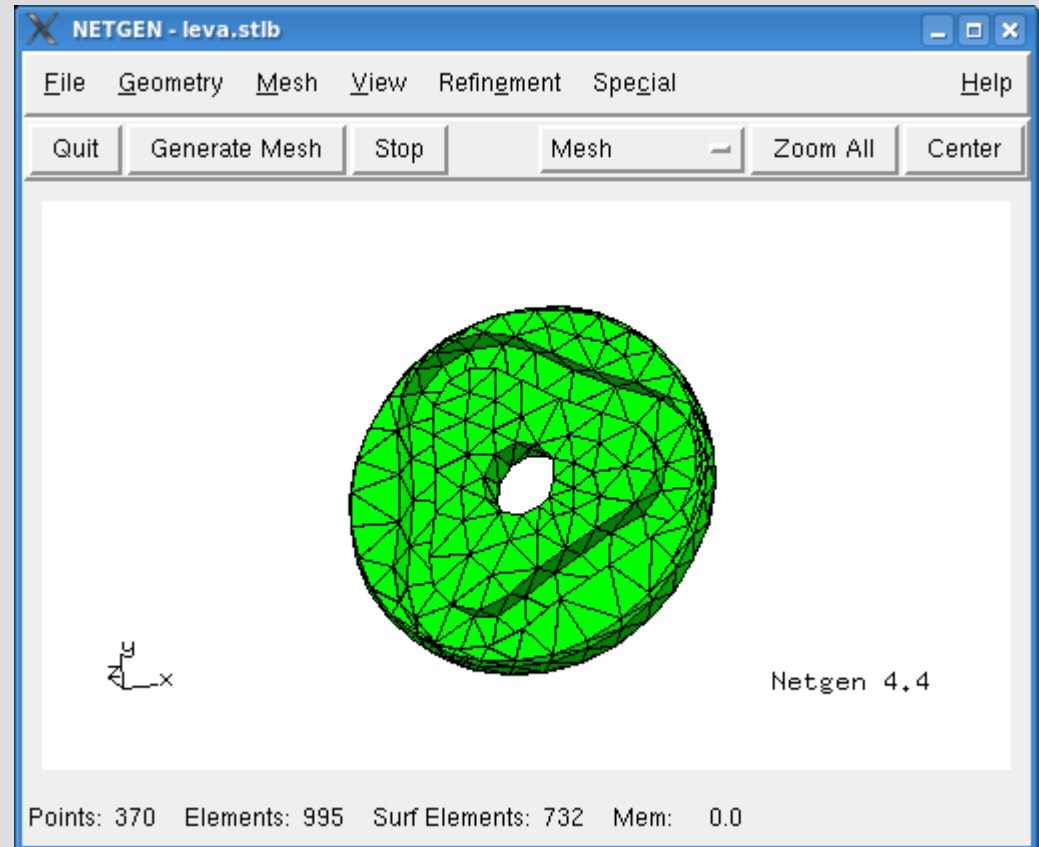
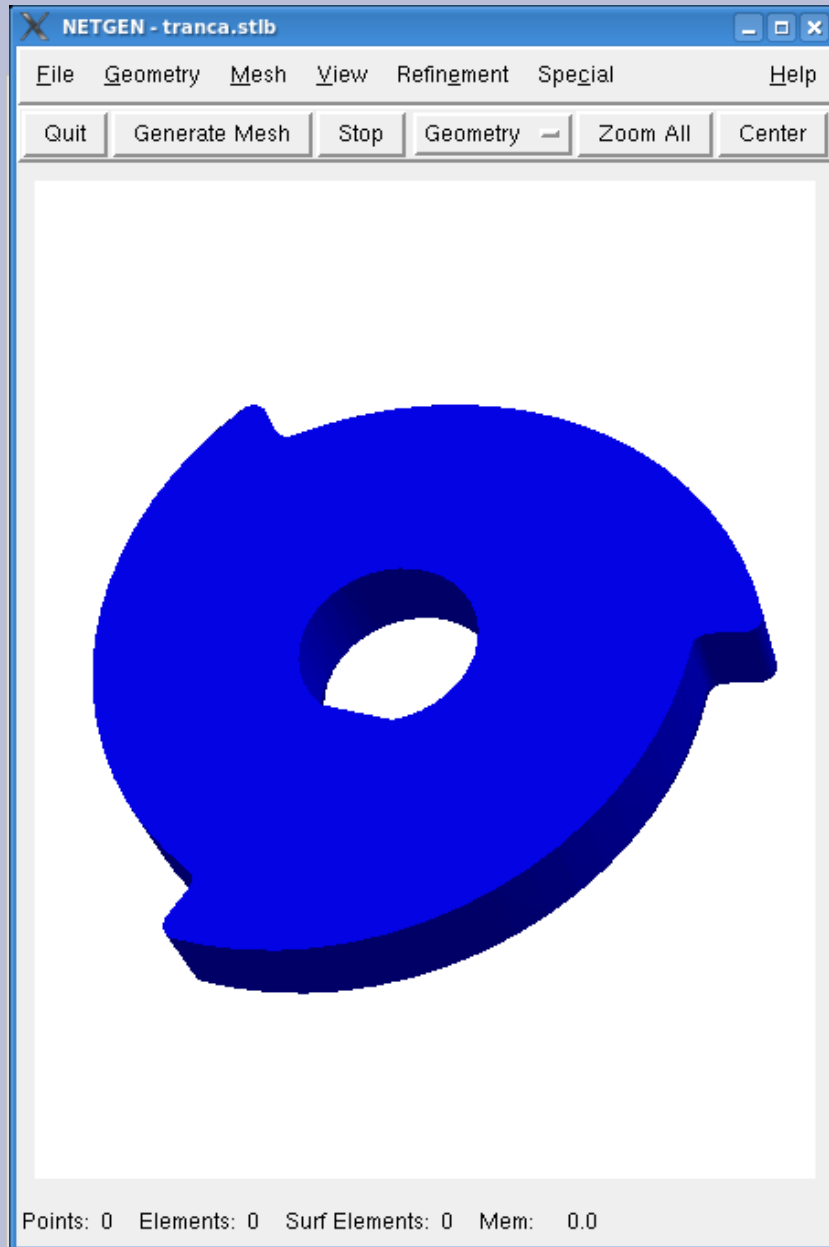
vulgata.
pdf

UserManua
l.pdf

Some ScreenShots



My machine



```
login <3>
ERROR: failure in trk:S03F, Line L03V will be straight
key: from string not known

gtol set to:4.844010e-04

done

GL_MAX_EVAL_ORDER:30
starting help: firefox /usr/local/share/doc/CalculiX/ccx/ccx.html
mesh all
please wait for 'ready'
ready
LoadPlugin: failed to initialize shared library /usr/local/lib/browser_plugins/n
pwrapper.libflashplayer.so [/usr/lib/libpthread.so.2; Undefined symbol "__malloc
_lock"]
LoadPlugin: failed to initialize shared library /usr/local/lib/browser_plugins/n
pwrapper.nphelix.so [/usr/lib/libpthread.so.2; Undefined symbol "__malloc_lock"]
plus ea all
send all abq
please wait for 'ready'
file all.msh opened
write abaqus data
ready
[]
```

```
login <4>
cannot be requested in local orientations;
the global orientation will be used

STEP          4

Frequency analysis was selected

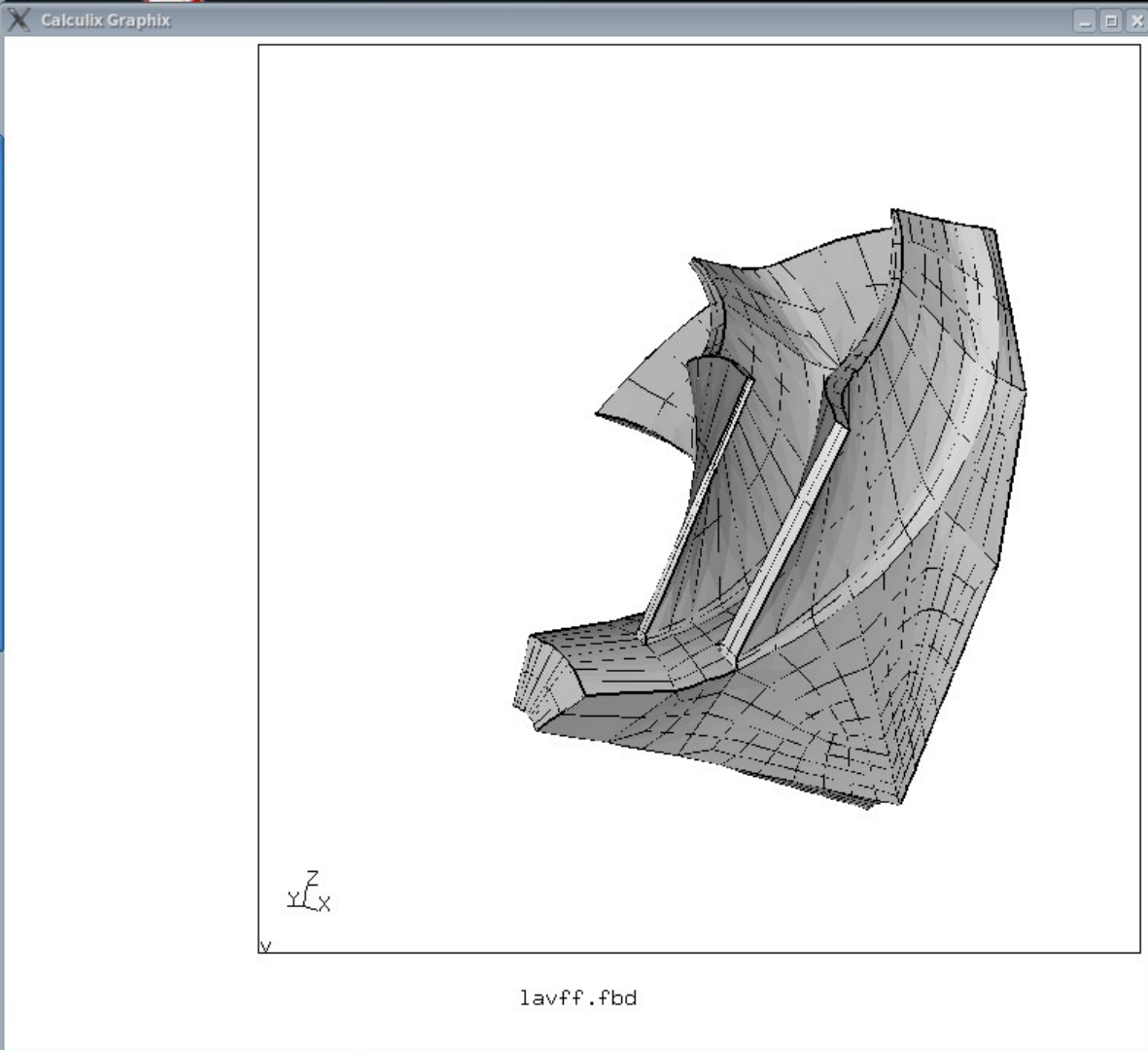
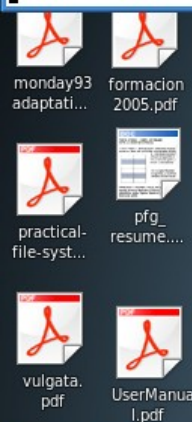
Perturbation parameter is active

Decascading the MPC's

Renumbering the nodes to decrease the profile:
old profile =      0 *2147483647+      6380692
new profile =      0 *2147483647+      2252673

Determining the structure of the matrix:
number of equations
38408
number of nonzero matrix elements
3164928
Factoring the system of equations using spooles

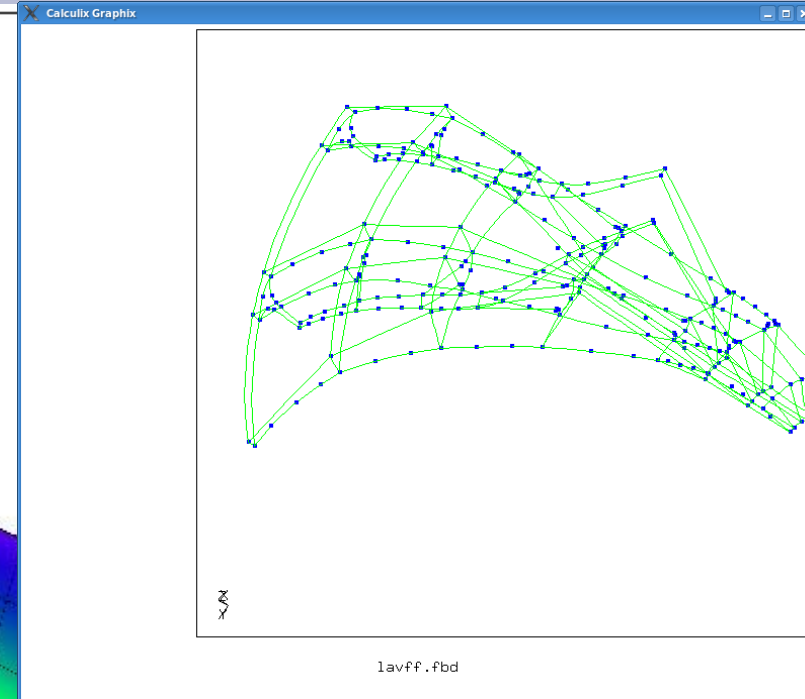
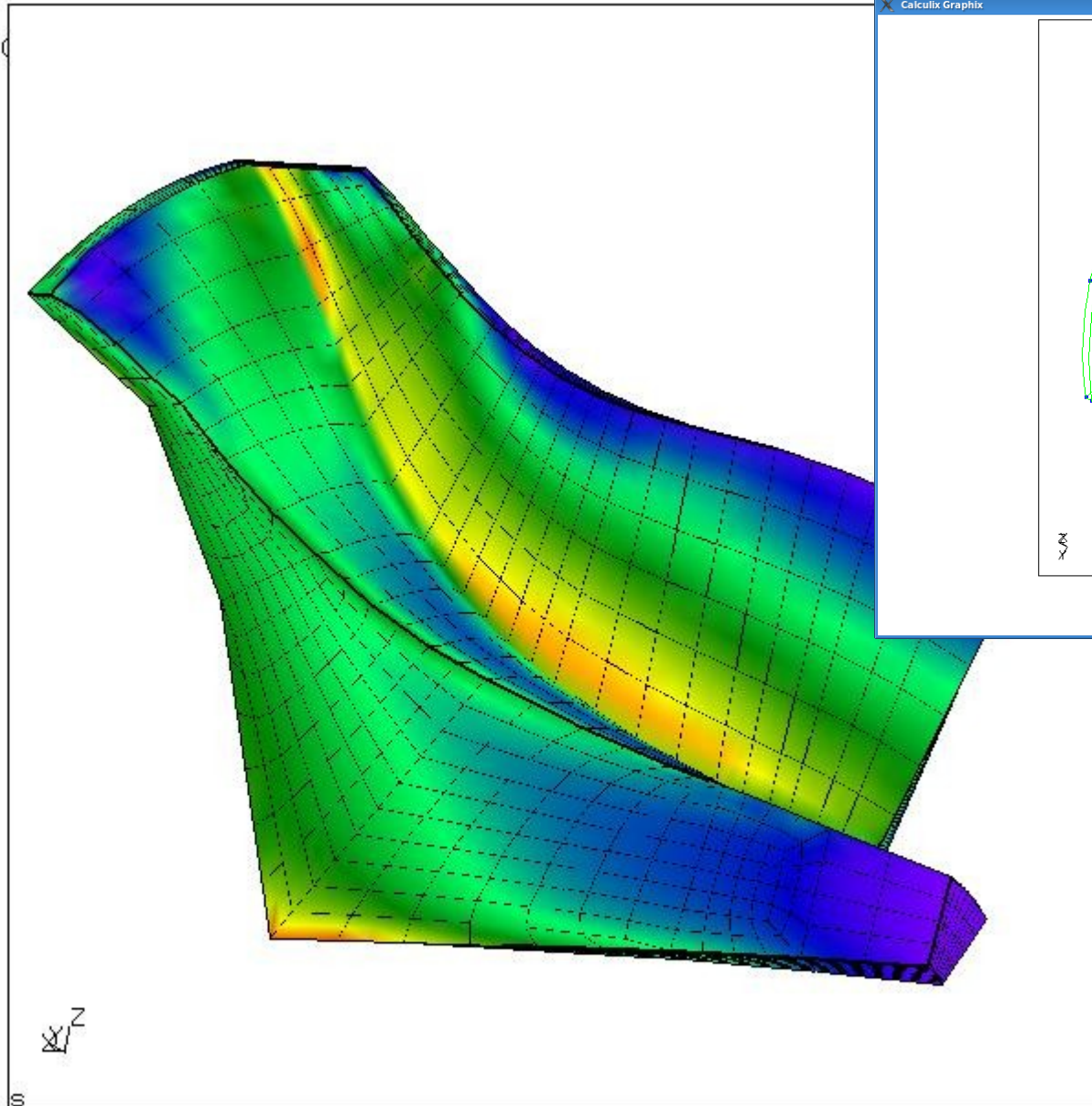
[]
```



More of the same

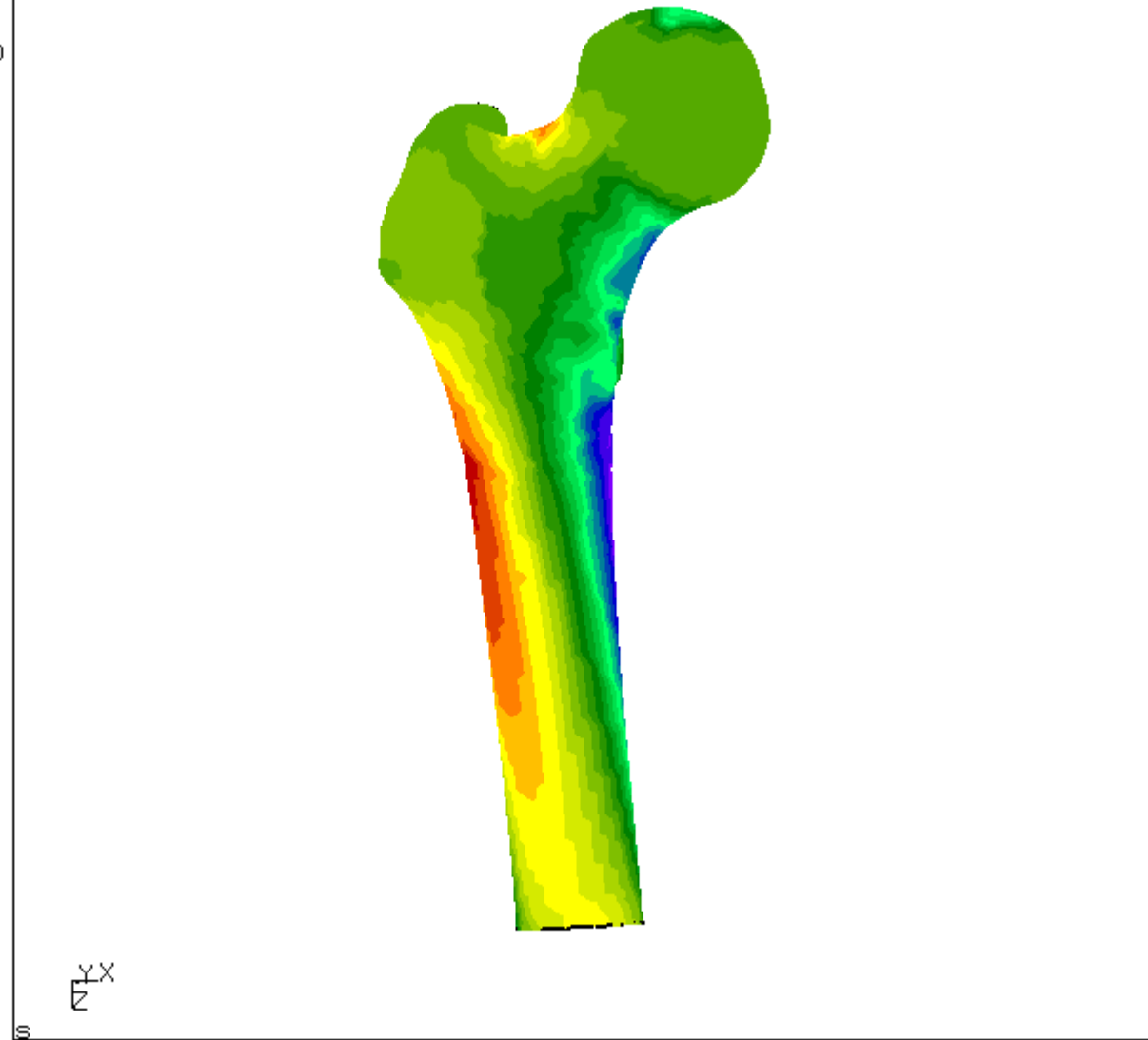
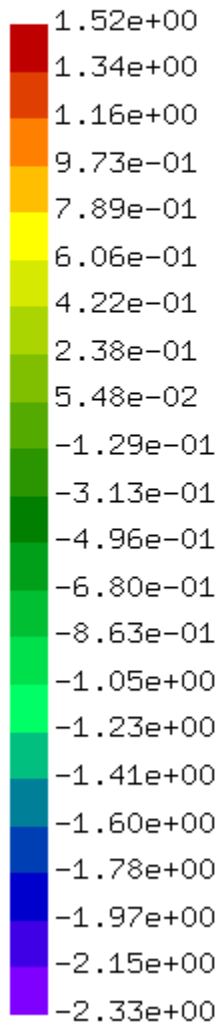
LC4:
+ STRESS 0.1000
entity:
Mises
max: 3.38e+02
min: 1.12e+00

3.38e+02
3.22e+02
3.06e+02
2.90e+02
2.74e+02
2.58e+02
2.42e+02
2.26e+02
2.10e+02
1.94e+02
1.78e+02
1.62e+02
1.46e+02
1.30e+02
1.14e+02
9.74e+01
8.14e+01
6.53e+01
4.93e+01
3.32e+01
1.72e+01
1.12e+00



Understanding the Results

LC3:
+ STRESS 0.0000
entity:
maxabsPs
max: 1.52e+00
min: -2.33e+00



Femurkopf2.frd

The Future

- More of the Same ...
- Salome-Code Aster
- VisIt
- DAKOTA
- Effect of Dtrace?