ANSYS-Mode

ANSYS-Mode APDL and Syntax Highlighting 15cm25cm

ANSYS-Mode Highlighting and APDL Reference

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Contents

1 WorkBench to APDL Translation

1.1 Material Models

1.1.1 Plasticity

Multilinear Kinematic Hardening (MISO) Implementation:

```
TB,PLAS,1,1,2,MISO
```

This means that one must input the curve in plastic strains and **not** engineering strains!

1.2 Boundary conditions

forces it is possible to apply time and spatially varying loads either tabular or functional. Example (depending on the coordinate sys.): =10*sin(x)

moment scope: geometric selection, named selection, remote point contact pair: conta174, targe170 and pilot node similar to remote point pilot node is placed at the centre of the geom. curvature moment is applied around the reference coordinate system. pinball radius (might) reduce(s) the memory intensive range of participating elements

remote point contact pair with reference geometry and pilot node(point)

remote force contacts with pilot node MPC formulation (flexible or rigid)

pressure surf154, sf

force surf154, sfe "line force": surf156, sfe

bolt pretension prets179 (WB: select only ONE face for whole stud!)

bearing load surf154,Elements selected in load direction and pressure load applied on projected area (WB: select ALL faces of a cylinder!)

hydrostatic pressure surf154, sfgrad and sf

Pressure Surface elements `surf154` and surface loads on elements (`sfe`)

```
/com,*********** Define Pressure Vector Using Surface Effect Elements ***********
local,12,0,0.,0.,0.,0.,0.,0.
csys,0
et,2,154
```

```
 eblock,10,,,10
 (15i9)
       61         2         2         2        12       116       107        67        66       398
       62         2         2         2        12       115       114       107       116       407
       63         2         2         2        12       107       108        68        67       396
       64         2         2         2        12       114       113       108       107       406
       65         2         2         2        12       108       109        69        68       399
       66         2         2         2        12       113       112       109       108       405
       67         2         2         2        12       109       110        70        69       401
       68         2         2         2        12       112       111       110       109       404
       69         2         2         2        12       110       106        71        70       395
       70         2         2         2        12       111       105       106       110       394
 -1
 esel,s,type,,2
 keyop,2,2,1               ! Apply load in local coordinate system
 keyop,2,11,2              ! Use real and not project area
 esel,all

 *DIM,_loadvari28x,TABLE,2,1,1,TIME,
 ! Time values
 _loadvari28x(1,0,1) = 0.
 _loadvari28x(2,0,1) = 1.
 ! Load values
 _loadvari28x(1,1,1) = 0.
 _loadvari28x(2,1,1) = -1.


 *DIM,_loadvari28y,TABLE,2,1,1,TIME,
 ! Time values
 _loadvari28y(1,0,1) = 0.
 _loadvari28y(2,0,1) = 1.
 ! Load values
 _loadvari28y(1,1,1) = 0.
 _loadvari28y(2,1,1) = -1.


 *DIM,_loadvari28z,TABLE,2,1,1,TIME,
 ! Time values
 _loadvari28z(1,0,1) = 0.
 _loadvari28z(2,0,1) = 1.
```

```
  ! Load values
  _loadvari28z(1,1,1) = 0.
  _loadvari28z(2,1,1) = 0.

  ...

esel,s,type,,2
nsle
sfe,all,1,pres,1,%_loadvari28x%
sfe,all,2,pres,1,%_loadvari28y%
sfe,all,3,pres,1,%_loadvari28z%
nsel,all
esel,all
```

displacements

remote displacement x,y,z, displacments are for the pilot node NOT the entire area!

simply supported hinge for beams (rotations are free)

elastic support surf154, r(4)=foundation stiffness, default thickness=1, damping possible

cylindrical support rotation with nmodif,node,x,y,z,thxy,...

compression only support rigid surf2surf contacts

Frictionless Support Fixing normal displacement with (`d`), possibly modifying nodal coordinate system (`nmodif`), turning into normal direction.

```
/com,********* Frictionless Supports X *********
CMBLOCK,_FRICSUX,NODE,       48
(8i10)
61        62        63        64        65        66       115       116
       117       118       119       120       121       122       123       124
       ....
       408       409       410       411       412       413       414       415
       416       417       418       419       420       421       422       423
cmsel,s,_FRICSUX
d,all,ux,0
nsel,all
```

```
nsel,all
/com,********** Node Rotations **********
nmod,61,,,,-43.6672749853753,0.,0.
...
```

2 APDL Reference

2.1 Idiosyncrasies

- You can only store strings of 32 characters, for only!! 128 characters you need to create a string array!
- No function definitions <- write 'command' files (suffix: .mac), or call a macro (arbitrary suffix) with '*use', something close is to fill a "table" arry, interpolating values and possible real indexing A(0.3).
- you can get table array values with real index values but must use integers for assigning them the values, the same goes for *vplot: it needs the arry indices in integers and is, moreover, only capable to plot the columns and not their line values!
- *vplot does only plot the columns of arrys, it is not possible to specify rows
- No direct array values to file export in GUI mode <- write command file for *vwrite, or use a (lookup) table for this purpose
- *vwread does not work with C format specifiers in contrast to *vwrite
- Still (v15) no **round** function in sight, but someting like nint(max*1e3)/1e3 might do
- One cannot easily get the variable value, either one must assign the variable to another one, or use the '*stat' command
- Operators > and <: $1 < 2 = 1$; $2 < 1 = 1$; $2 > 1 = 2$:TODO check
- Inconsistent naming: /{x,y}range but /axlab,{x,y},
- The /contour command does not work on device /show,PNG
- DELETION OF ARRY parameters without warning only possible with an undocumented option: *del,Array,,nopr

- *cfwrite does parameter substituion without %%: *cfwrite, X_points = NoN,*cfwrite, the same as X_points = %NoN%????
- No direct operation on arrays like A=A*3, take a detour with *voper or *toper
- Load symbol vectors /pbc,all,,1 in /prep7 are uniform in contrast to the more ralistic ones in /solu

2.2 File types (the whole zoo is in the operations guide) under Gnu/Linux?

No	Type	Name	temp.	Ren
1	abort	.abt		
2	graphics annotation commands	.ano	yes	
3	neutral file format	.anf	no	
4	animation	.anim		
5		.ans_log		
6	input data copied from batch input file /batch	.bat	yes	
7	sparce solver	.bcs	no	run
8	interpolated body forces (bfint)	.bfin	no	
9		.cdb		
10	sparce solver	.dsp		run
11	interpolated DOF data (cbdof)	.cbdo	no	
12	color map	.cmap	no	
13	default command file suffix (*cfopen, *cfwrite)	.cmd	no	
14	component mode synthesis	.cms	no	
15	nonlinear diagnostics file (nldiag)	.cnd	no	
16	pcg solver	.pcs		run
17	workbench solver input	.dat		
18	database	.db		
19	db backup	.dbb		
20	databas from vmseh failure in batch mode	.dbe	no	
21	fortran solution information	.dbg	no	
22	Do-loop nesting	.do#	yes	
23	scratch file modal analysis	.dscr	yes	
24		.D#		
25	perfomance information sparse solver distributed	.dsp	no	
26	scratch file distributed sparse solver	.dsp#		
27	Superelement DOF solution from use pass	.dsub	no	
28	Element definitions (EWRITE)	.elem	no	
29	element matrices	.emat		
30	element saved data	.esav		
31	errors and warnings	.err		
32	distributed memory	#.err		
33	rotated element matrices	.erot	yes	
34	Element saved data ESAV files created by nonlinear analyses	.esav	yes	
35	scratch file PCG Lanczos eigensolver	.evc	yes	
36	scratch file PCG Lanczos eigensolver	.evl	yes	
37		.ext		
38		.exti		
39	local results file distributed memory	#.ext		
40	stiffness-mass matrices	.full		
41	Fatigue data [FTWRITE]	.fatg	no	
42	neutral graphics file	.grph	no	
43	Graphical solution tracking file	.gst	no	
44	IGES file from ANSYS solid model data [IGESOUT]	.iges	no	
45	initial state	.ist		

- .mac
- .db
- .dbb

2.3 Defining parameters

up to 5000

2.3.1 Double, char38, char8?, logical? TODO:

in table only 8 chars?

2.3.2 Variable names (called 'parameter' in the ANSYS manual)

All numeric values are stored as double precision values. Not defined variables are assigned a tiny value near zero. The interpreter is not case sensitve :TODO except in strings?

Must begin with a letter or an underscore

```
1ansys = 3                    !is not a valid variable name
a1nsys = 3                    !a1nsys is a valid variable name
A1NSys = 4                    !this is the same variable
A1NSys = Temp                 !'Temp' is not defined
```

The following text is the respective ANSYS solver/interpreter output.

```
BEGIN:
 1ansys = 3                    !is not a valid variable name
PARAMETER 1ANSYS =     3.000000000
*** ERROR ***                           CP =       0.259   TIME= 18:06:41
Invalid character in parameter name.
 The setting of parameter= 1ANSYS is ignored.
BEGIN:
 a1nsys = 3                    !a1nsys is a valid variable name
PARAMETER A1NSYS =     3.000000000
BEGIN:
 A1NSys = 4                    !this is the same variable
PARAMETER A1NSYS =     4.000000000
BEGIN:
```

```
 A1NSys = Temp                  !‘Temp’ is not defined
*** WARNING ***                          CP =       0.260   TIME= 18:06:56
Unknown parameter name= TEMP.  A value of 7.888609052E-31 will be used.
PARAMETER A1NSYS =    0.7888609052E-30
BEGIN:
```

Should not begin with an underscore This convention is used in naming variables in ANSYS supplied macros and the GUI.

```
_ansys = 3   !‘_ansys’ represents a reserved variable in ANSYS supplied macros
_ = 3        ! a single underscore definition is valid
X = _
_ = 3 !the single underscore represents  also a ‘variable’ in APDL
```

Variable names with a trailing underscore These are hidden from the ‘*status’ command output and can be deleted as a group with ‘*del’.

```
ansys_ = 3              !this is a ‘hidden’ variable from *status
*status                 !does not show ‘ansys_’
       ,PRM_            !show variables with trailing underscore
*del,,PRM_              !delete all variables with trailing underscore

 BEGIN:
ansys_ = 3
 PARAMETER ANSYS_ =     3.000000000
 BEGIN:
 *status
 ABBREVIATION STATUS-
  ABBREV    STRING
  SAVE_DB   SAVE
  RESUM_DB  RESUME
  QUIT      Fnc_/EXIT
  POWRGRPH  Fnc_/GRAPHICS

 PARAMETER STATUS-           (      5 PARAMETERS DEFINED)
  (INCLUDING        4 INTERNAL PARAMETERS)

 NAME                              VALUE                          TYPE  DIMENSIONS
 X                                 3.00000000                      SCALAR
 BEGIN:
```

```
,PRM_
 PARAMETER STATUS- PRM_      (      5 PARAMETERS DEFINED)
  (INCLUDING        4 INTERNAL PARAMETERS)

 NAME                              VALUE                          TYPE  DIMENSIONS
 ANSYS_                            3.00000000                      SCALAR
 BEGIN:
```

Must contain only letters, numbers and underscores

```
!! only letters, numbers and underscores are allowed
a1n§sys = 3              !this is not a valid variable name
a1n_sys = 3              !this is a valid variable name
```

the ANSYS interpreter output looks like this:

```
BEGIN:
 a1n§sys = 3              !this is not a valid variable name
*** ERROR ***                           CP =       0.256   TIME= 17:35:07
Invalid character in parameter name.
 The setting of parameter= A1N§SYS is ignored.
BEGIN:
 a1n_sys = 3              !this is a valid variable name
PARAMETER A1N_SYS =     3.000000000
BEGIN:
```

Must contain no more than 32 characters

```
!! The following is not a valid variable name
v23456789_123456789_123456789_123 = 3
!! The following is a valid variable name
v23456789_123456789_123456789_12  = 3
```

Local Variables

```
Depth  =  ARG1 !ARG{1-9}, AR{10-19} = "*use" variables
AR18 = AR19
*stat,argx
```

2.3.3 Character strings

Must not contain more than 32 characters

```
! character string variables are enclosed with ‘’’
Yc = ’01234567890123456790123456789012345’ !not a character variable any more
Symetry = ’yes’
```

2.4 Erasing variables from memory

```
!! defining
Scalar = 3                !the ‘=’ assignment is a shorthand for ‘*set’
*set,Scalar,4             !reassignment
*set,Vector,1,2,3,4,5,6,7,8,9,10
Vector = 0,1,2,3,4,5,6,7,8,9,10,11,12 !TODO:
Vector = 4                !TODO:
!! deleting
Scalar =     !this is not a variable any more
*set,Scalar               !alternative to ‘Scalar =’
*del,all                  !delete all variables!
*del,Vector   !TODO:
```

2.5 Variable substitution with ‘%’

2.5.1 Substitution of Numeric Variables

In "string commands" like ‘/com’, where a string follows the command name one can force the substitution of a parameter name to its value. Other examples are

```
Steel = 1
/com,Material %Steel% is steel
!! ATTENTION: in the following situation!
/com,%Steel% does NOT substitute variable Steel
/com, %Steel% does substitute variable Steel
/com,Stuff like %Steel+1% returns 2
```

2.5.2 Substitution of Character Variables

It is possible to substitute a command name

```
R=’RESUME’
%R%,MODEL,DB
```

```
!! string, message commands and comment behaviour && %$$% %% :bla: &&&

/com, bla = %bla%
igesin,'test','%iges%'
/title,Nothing in %particular%
!! in "string commands" are no code comments possible
/com,beam3 %YES% ! this is *really not commented out!!!! &
c*** *beam3 !otto *otto %neither% here !!!!!!! &
/com, bearm laskf %otto% !%otto% we are here
```

In certain 'string commands' `/title` and `/com` are string commands similar to `c***`

```
right = 'wrong'
/title, the value of right is  %right%
/com, this is %right%: /com does expand parameters as well
```

Unfortunately here is no expansion possible neither with `c***` nor with `/sys`

```
right = 9
c***,this is %right%: c*** allows no parameter expansion
/sys,ls "*.mac" %otto% &
/syp,ls, %otto% !this is not working, no substitution!
I = 1
otto = 'file00%I%.eps'
/syp,ls, otto !this is working as intended
```

2.5.3 Dynamic Substitution of Numeric or Character Variables

or forced substitution (deferred)

```
Case = 'case 1'
/title,This is  %Case%
 !/stitle
 !*ask
 !/tlabel
 !/an3d
 !in tables TODO:
aplot
Case = 'case 2'
```

```
!! not necessary to reissue /title, "This is case 2"
!! will appear on subsequent plots
aplot
```

2.6 Expressions

2.6.1 Exponentiation Operator is '**'

2.6.2 Multiplication Expression

Beware of the oldstyle ANSYS comment!

```
var1 = sinh(cos(3 *5)) ! old style Ansys comment!!!!!
var2 = sinh(cos(3*5))  ! this is valid code
fini * comment
otto = 3 * 4 comment, the value of otto = 3!
!!
```

2.6.3 Operators: '<' and '>' :TODO

```
otto = 1.82
karl = 1.97
margret =  otto < karl !margret = otto
maria = karl < otto    !maria = otto
*status,karl > otto
```

2.7 Arrays

4 types: array, char of 8 characters, table and string 128 chars

2.7.1 Specifiying array element values

2.7.2 APDL Math

APDL Math works in its own workspace independent of the APDL environment!

```
No = 100
Pi = acos(-1)
Dat = cos(0:2*Pi:(2*Pi/No))+ cos(0:2*Pi*10:(2*Pi/No))
Dat = 0:2*Pi:2*Pi/No
*vfun
*vec,import,apdl,Dat
```

```
*fft,Forw,Dat,OutDat,,,Full !what's the difference?
*fft,    ,Dat,OutDat,,,Part !what's the difference?
*export,OutDat,apdl,APDLOutDat
```

2.8 debugging

```
debug                    !TODO: undocumented?
```

2.9 Multiple runs, probabilistic design

```
PDEXE, Slab, MRUN, NFAIL, FOPT, Fname
in V11: *mrun                     !TODO:
```

2.10 Undocumented commands

```
!undocumented commands are highlighted differently
/xml                     !undocumented command /xml
/xfrm                    !documented command   /xfrm
```

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dkgreenrgb0,0.5,0 dkredrgb0.5,0,0 grayrgb0.5,0.5,0.5 frame=none, basicstyle=, `morekeywords=virtualinvoke, keywordstyle=dkgreen, ndkeywordstyle=red, commentstyle=dkred, stringstyle=orange, backgroundcolor=white, tabsize=4, xleftmargin=.23in`

ansys morecomment=[l]!, morecomment=[l] *, morestring=[b]', sensitive=false, morekeywords=nsel,et,mp,block,d,vmesh,allsel,save,solve,plnsol,finish, aplot,eplot,igesin,set,lfillt, otherkeywords=*MSG,*if,*do,*enddo,*dowhile,*create,*end,*endif,/title,/co /units,/prep7,/solu,/post1,/post26,/eof,/image,/sys,*afun,/view,c***,*get, *msg,/xfr,*vwrite,*go,*dim /tlab,/erase,/annot,/pspe,/pwed,/poly,*vscfun,/tlab,

3.1 Header

```
!! ------------------------------
!@ --- header ---
!! ------------------------------
!! Time-stamp: <2012-06-22 16:42:24 uidg1626>
!! NOTE: This is APDL pseudo code, checking
!!  ANSYS-Mode's highlighting capabilities and
!!  certain aspects of the language
!!  Please see further below.
```

```
/units,mpa !indicate mm-t-s unit system
!@ --- Preprocessing ---
/prep7
!@@ -- Elements --
Steel = 1
ID = Steel
real = Steel
et,ID,solid186 !3d, 20 node
!@@ -- Material --
mp,nuxy,Steel,0.3 ! Poisson No
mp,ex,Steel,200000 ! Elastic modulus
!@@ -- Modeling --
block,0,1,0,1,0,1
!@@ -- Meshing --
vmesh,all
!@@ -- BCs, Loads --
nsel,s,loc,x,0
d,all,all
nsel,s,loc,x,1
d,all,uy,-.1
allsel
save
!@ --- Solving ---
/solu
solve
!@ --- Postprocessing --
/post1
/view,,1,1,1
plnsol,u,sum,2
/image,save,test !save XWindow Dump xwd (or bmp on Windows)
/image,capture                !TODO: what is this: file0001.xwd?
/sys,convert test test.png
/upwind                  !TODO: 2d-graphics library? dated?
*fft                     !TODO: :-)

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!  Please put the the cursor below the next paragraph of emacs lisp
!!  code and type "C-x C-e" to change the setting of
!!  ‘ansys-highlighting-level’ and ‘ansys-dynamic-highlighting-flag’
!!  change the level from 0 to 2 and toggle the flag from ‘t’ to
```

```
!!  'nil'.  Browse the file to check the differences.

(progn
  (when
      (featurep 'ansys-mode)
    (unload-feature 'ansys-mode))
  (setq
   ansys-highlighting-level 2
   ansys-dynamic-highlighting-flag t)
  (load-file "ansys-mode.el")
  (ansys-mode))
```

:TODO !! ——————————— /units,mpa !indicate mm-t-s unit system c

```
!@@ -- Ignored characters and condensed input line ($ operator)
finishThisNightmare $ /cle !/clear
f $ fi $ fin $ fini $ finis  $ finish $ finisher
```

3.2 Highlighting APDL specials

3.2.1 Reserved words and _RETURN statements

```
!!
N      =  _RETURN       !return value of certain commands
Alpha2 =  +360./(2*N)
Xc     =  !empty rhs clears variables
```

3.2.2 _RETURN values of macros

```
*return                  !TODO: what is this?
*status,_RETURN          !0 normal
 !1 note
 !2 warning
 !3 error
 !4 fatal
```

3.2.3 Old style APDL comments

```
var1 = sinh(cos(3 *5)) ! old style Ansys comment!!!!!
var2 = sinh(cos(3*5))  ! this is valid code
fini * comment
```

```
otto = 3 * 4 comment, the value of otto = 3!
!!
```

3.2.4 Ignored characters behind commands

```
f $ fi $ fin $ fini $ finis  $ finish $ finisher
!!
```

3.2.5 The End Of File command

```
/eof --- WARNING: /eof crashes the Ansys GUI in interactive mode ---
!!

!@@ -- function names --
Pi=acos(-1) $ True=1 $ False=0 $ Nn=3.1
Alpha1 = rotx( 14.5) - 360./ (2*Nn)
```

3.2.6 Ignored characters behind commands

```
f $ fi $ fin $ fini $ finis  $ finish $ finisher
a $ al $ all $ alls $ allse $ allsel $ allsellllll
rectngaaaaa,var1,_X2,var2,X2 ! 2d rectangle
!!
```

3.2.7 The End Of File command

```
  /eof --- WARNING: /eof crashes the Ansys GUI in interactive mode ---
  /exit,nosave           !default is save the model data
!!
```

3.2.8 Current element types and deprecated elements

```
!! A current element type:
et,10,solid186
!! deprecated element types:
et,Steel,beam3 $ et,Alu,shell91
!!
```

Let's change the element types to current ones!

```
!! Complete the following element fragments to current ones!
!!
et,Steel,beam $ et,Alu,shell
```

For example select the following elements

```
et,Steel,beam188 $ et,Alu,shell28
```

and you are getting a diffent element highlighting.

```
!@@ -- default commands
nsel,s,loc,y,0
    ,a,loc,y,1
    ,r,loc,x,0
d,all,all
```

3.3 Implied (or colon) looping

```
!@@ ::: implicit : (colon) looping :::::
!! (n1:n2:dn)
lfillt,(1:2),(3:4),5
!! one subscript per array
bf,(1:10),temp,Tarray(1:10)
b(1:5) = 10,20,30,40,50 !TODO: creates this an array?
!! The *get command and get functions are allowed
*get,Fx(1:10),node,(1:10),f,fz !TODO:
a(1:5) = nx(1:5)
!! TODO:
Fx(1:10) = (1:100:10)    !is this working? :-)
!! alternative to *vfill
*vfill,Fx,ramp,1,10

!! looping
*get,Dim
*if,Dim,le,1,then
  *dim,Reaction,array,Ns,1
*endif
*do,I,1,Ns
  set,Ls,I
  fsum
  *get,Fx,fsum,,item,fx
  Reaction(I)=Fx
*enddo

!@@ -- multiline *msg formatting with the & operator
```

```
*MSG,UI,Vcoilrms,THTAv,Icoilrms,THTAi,Papprnt,Pelec,PF,indctnc
Coil RMS voltage, RMS current, apparent pwr, actual pwr, pwr factor: %/ &
Steel = %G A (electrical angle = %G DEG) %/ &
_Power factor: %G %/ &
Inductance = %G %/ &
VALUES ARE FOR ENTIRE COIL (NOT JUST THE MODELED SECTOR)
```

4 And the rest

*taxis only for 3 dimension? table(0,1) = 3 is working as well

```
!@@ --! multiline message format command this is tricky: use M-o M-o
*MSG,UI,Vcoilrms,THTAv,Icoilrms,THTAi,Papprnt,Pelec,PF,indctnc
Coil RMS voltage, RMS current, apparent pwr, actual pwr, pwr factor: %/ &
Steel = %G A (electrical angle = %G DEG) %/ &
_Power factor: %G %/ &
Inductance = %G %/ &
VALUES ARE FOR ENTIRE COIL (NOT JUST THE MODELED SECTOR)
aldk this is not any longer in the *msg format construct
/com this is not any longer in the *msg format construct

*vwrite,B(1,1),B(2,1),%yes%
alkd %D &
%E%/%E

!! commands which do not allow arguments
/prep7 $ FINISH !$ means nothing behind
/prep7 !still nothing behind
/prep7 * old style comment, this is allowed
/prep7 this is an error

nsel,s,loc,x,1
nsel = 3  !you CAN have variable names clashing with commands

!@@ -- Goto branching --
*go,:branch
aselsalsdkfjaölsdkfjaölskdjf,all
:branch

!------------------------------------------------------------------------
```

```
! mdlbl.mac
! Puts Modal Info on Plot
!------------------------------------------------------------------------
/post1
set,last
*get,nmd,active,,set,sbst
pfct= $ ffrq= $ adir=
nsel,s,l

*dim,pfct,,nmd,6
    ,
    ,ffrq,,nmd
    ,adir,char,nmd


adir(1) = 'X','Y','Z','ROTX','ROTY','ROTZ'
*stat,adir
*do,i,1,nmd
  *get,ffrq(i),mode,i,freq
  *do,j,1,6
    *get,pfct(i,j),mode,i,pfact,,direc,adir(j)
  *enddo
*enddo
/annot,delete
/plopt,info,0
/plopt,minm,off
/triad,off
/erase
iadd = arg1
*if,iadd,eq,0,then
  iadd = 1
*endif
/tspe,15,1,1,0,0
/TSPE, 15, 1.000,   1,   0,   0
xx = 1.05
yy = .9
!  Change the window settings if you need different
!  aspect ratios for your geometry
/win,1,-1,1,.5,1
    ,2,-1,1,0,.5
```

```
    ,3,-1,1,-.5,0
    ,4,-1,1,-1,-.5
!
/win,2,off
/win,3,off
/win,4,off

*get,vx,graph,1,view,x
*get,vy,graph,1,view,y
*get,vz,graph,1,view,z
*get,va,graph,1,angle
*get,vd,graph,1,dist
*do,i,2,4
  /view,i,vx,vy,vz
  /dist,i,vd
  /angle,i,va
*enddo

*do,i,1,4
  ii = i - 1 + iadd
  set,1,ii
  plnsol,u,sum
  *if,i,eq,1,then
    /noerase
  *endif
  /win,i,off
  *if,i,ne,4,then
    /win,i+1,on
  *endif
*enddo
*do,i,1,4
  ii = i - 1 + iadd
  /TLAB, xx, yy  ,Mode: %ii%
  yy = yy - .05
  /TLAB, xx, yy,Freq: %ffrq(ii)%
  yy = yy - .05
  *do,j,1,6
    /TLAB, xx, yy  ,PF %adir(j)%: %pfct(ii,j)%
    yy = yy - .05
  *enddo
```

```
   yy = yy -.11
*enddo
/erase
/annot,delete
sz = .8
xloc = 0
yloc = 0

*dim,data,,5
data(1) = 12,15,28,10,32
hsz = sz/2

/pspec,0,1,1
/poly,4,xloc-hsz,yloc-hsz,1.8*(xloc+hsz),yloc-hsz,
 1.8*(xloc+hsz),yloc+hsz,xloc-hsz,yloc+hsz

x0 = xloc + hsz
y0 = yloc + .7*hsz
lof = .05

*vscfun,dsum,sum,data(1)
/LSPE, 15, 0, 1.000
/TSPEC, 15, 0.700, 1, 0, 0
ang1 = 0
*do,i,1,5
  ang2 = ang1 + (360*data(i)/dsum)
  /PSPE, 2*i, 1, 1
  /PWED, xloc,yloc,sz*.4, ang1,ang2
  /poly,4,x0,y0,x0+lof,y0,x0+lof,y0+lof,x0,y0+lof
  pvl = 100*data(i)/dsum
  /tlab, x0+1.5*lof,y0, %pvl% %

  y0 = y0 - 1.5*lof
  ang1 = ang2
*enddo
/eof
```