# GID-PAK INTERFACE

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**Abstract.** *GiD-PAK interface is a user interface between programs for pre and post processing – GiD and PAK program package. Basic instructions for developing the interface between the programs are given in the paper, with a specific review on PAK-S module. PAK-S is the program for linear and nonlinear static and dynamic structural analysis based on the Finite Element Method. Several Finite Element types are implemented in this program module as well as several material models. Developing GiD–PAK interface we get a powerful program tool for complex structural analysis.*

## 1 INTRODUCTION

GiD-PAK Interface is a user interface between programs for pre and post processing – GiD[i] and PAK[ii] program package. Software package PAK is on the level of world-known packages for structural analysis. There are built-in finite elements and material models according to the state-of-the art theoretical achievements. Program PAK-S includes modulus for solving static and dynamic analysis of constructions, geometrically and materially nonlinear problems, fracture mechanics, etc. Connecting of all PAK program modules and software for pre and post processing GiD is in process.

## 2 DESCRIPTION OF PAK-S INTERFACE SOFTWARE GID

Scheme of problem solving applying software GiD[iii] and PAK-S, using developed interface described in this paper, is given on the figure 1.

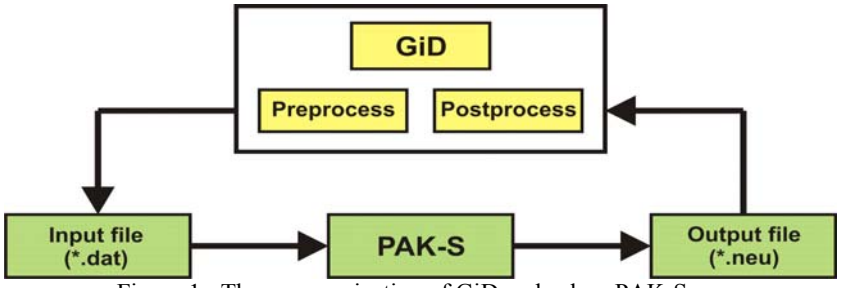



Figure 1 : The communication of GiD and solver PAK-S

After model defining in the mode for pre processing of program GiD, we get an ASCII file with the *.dat* extension on the output. This file is sent to solver PAK-S and on its output we get a *.neu* extension file that contains the results of the previously done analysis. Obtained result can be post processed now in the mode for post processing of GiD program.

In order to unite pre and post processor GiD and solver PAK-S into one program package where it is possible to do the complete analysis, as previosly mentioned, it is necessary to create an interface that connects these two parts.

Create a new folder with the solver name (PAK[iv] in this case) within the existing *Problemtypes* folder. This way PAK submenu will appear in GiD program *Problem type* menu. Then create *PAK-S.gid* folder within PAK folder. The entire translator that contains the following files will be placed in *PAK-S.gid* folder:

*Configuration files*

- PAK-S.cnd
- PAK-S.mat
- PAK-S.prb

*TCL extension files*

- PAK-S.tcl

*Template files*

- PAK-S.bas

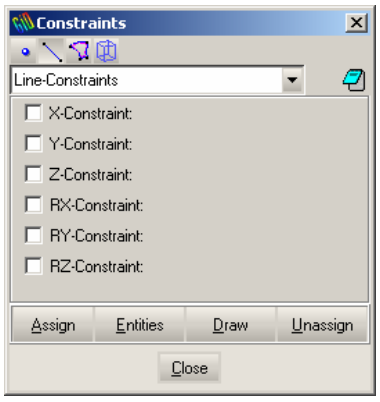
## 3 ANALYSIS OF GID–PAK-S INTERFACE FILES

### 3.1 Configuration files

File with the *.cnd* extension has the information about problem boundary conditions (constraint and load). An important characteristic of *Conditions* file is that it must be defined through which geometrical entities the boundary conditions are given (over points, over lines, over surfaces, over volumes or over layers), and which way these parameters are assigned to finite elements (over nodes, over face elements or over body elements). The structure of *PaK-S.cnd* file is briefly described in the following text.

There are two parts defined with the name *BOOK* within this file; *Constraints* and *Static_Loads*. The part of the code that refers to *BOOK Constraints* is next given, whereas a dialog window that creates this part of the code in GiD program graphical interface is presented on the picture next to the code.

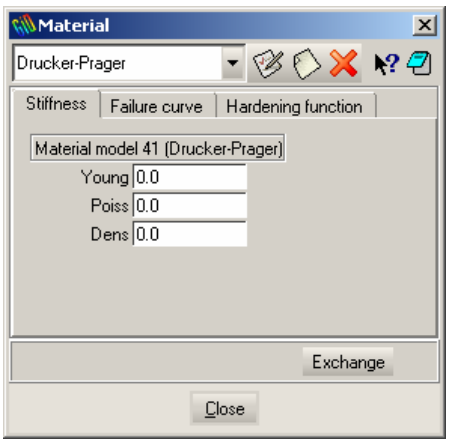
```
NUMBER: 2 CONDITION: Line-Constraints
  CONDTYPE: over lines
  CONDMESHTYPE: over face elems
    QUESTION: X-Constraint:#CB#(1,0)
    VALUE: 0
    QUESTION: Y-Constraint:#CB#(1,0)
    VALUE: 0
    QUESTION: Z-Constraint:#CB#(1,0)
    VALUE: 0
    QUESTION: RX-Constraint:#CB#(1,0)
    VALUE: 0
    QUESTION: RY-Constraint:#CB#(1,0)
    VALUE: 0
    QUESTION: RZ-Constraint:#CB#(1,0)
    VALUE: 0
```




File with the *.mat* extenstion has the information about different material models (*Material*) as well as the definitions of different finite element types with their characterisctis

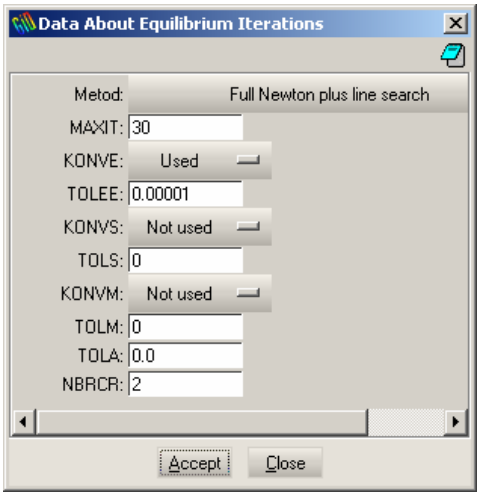
(*Property*). This file is divided into two parts as well: *BOOK Material* and *BOOK Property*, so that material models are independent from the finite element types and their characteristics. The part of the code that defines material characteristics of one of the material models implemented in PAK-S program and the dialog window that this code creates in GiD graphical interface follows.

```
NUMBER: 41 MATERIAL: Drucker-Prager
  TITLE: Stiffness
    QUESTION: matID
    VALUE: 41
    STATE: hidden
    COMMENT: Material model 41 (Drucker-Prager)
    QUESTION: Young
    VALUE: 0.0
    HELP: Young's modulus (E)
    QUESTION: Poiss
    VALUE: 0.0
    HELP: Poisson's ratio (ni)
    QUESTION: Dens
    VALUE: 0.0
    HELP: Material density
  TITLE: Failure_curve
...
END MATERIAL
```




File with the *.prb* extension has the information about the analysis type, post processing options, equilibrium iterations, permanent constraints, body loads, imperfection, fracture mechanics etc. It is different from the two previous files because it does not depend on geometrical entities. The information being input here is used to set the solver parameters. The example of code that creates the dialog window for defining Equilibrium iterations in the GiD graphical interface follows as well as the dialog window created by this code in the GiD graphical interface.

```
BOOK: Data_About_Equilibrium_Iterations
  QUESTION: Metod:#CB#(Elastic_tangent_matrix, . . . )
  VALUE: Full_Newton_plus_line_search
  . . .
  QUESTION: KONVE:#CB#(Used,Not_used)
  VALUE: Used
  QUESTION: TOLEE:
  VALUE: 0.0001
  QUESTION: KONVS:#CB#(Used,Not_used)
  VALUE: Not_used
  QUESTION: TOLS:
  VALUE: 0
  QUESTION: KONVM:#CB#(Used,Not_used)
  VALUE: Not_used
  QUESTION: TOLM:
  VALUE: 0
  QUESTION: TOLA:
  VALUE: 0.0
  QUESTION: NBRCR:
  VALUE: 2
```




### 3.2 TCL extension files

File with the *.tcl* extension automatizes any of the processes in GiD and new options can be assigned with it. The appearance of the entire PAK-S interface is defined within it, including the appearance of the created menu and submenu. *PAK-S.tcl* consists of numerous procedures that correspond to *TCL* language.

### 3.3 Template files

Within interface folder we create *PAK-S.bas* file that represents the main part of the interface between these two programs. After model defining it is necessary to write all the information in the input file with *.dat* extension that will be processed by PAK-S solver. This file describes format and data structure of the input file for the solver. It accepts solver data for the analysis in many cards that are divided into logical parts. The part of code template file that writes down the input file for PAK-S solver and refers to basic data for the problem defining follows.

```
C /4/ BASIC DATA FOR THE PROBLEM (6I2,3X,3I5)
C (IOPGL(I),I=1,6),NDIN,ISOPS,ICVEL
*if((strcmp(GenData(Static/Dynamic),"Static")==0))
*Set Var NDIN=0
*else
*Set Var NDIN=1
*endif
*if((strcmp(GenData(Eigenvalue),"0")==0))
*set var ISOPS=0
*else
*set var ISOPS=1
*endif
*set var ICVEL=1
*format "%2i%2i%2i"
*GenData(X-Constraint)*GenData(Y-Constraint)*GenData(Z-Constraint)*\
*format "%2i%2i%2i%8i%5i%5i"
*GenData(RX-Constraint)*GenData(RY-Constraint)*GenData(RZ-Constraint)*NDIN*ISOPS*ICVEL
```

In this card of the input file for the PAK-S solver the following is defined: the analysis type (static or dynamic), setting eigenvalue calculations, global translation and rotation. Parameters that are read and written in this card are defined in *PAK-S.prb* file.

## 4 CONCLUSION

GiD-PAK interface represents the connection between programs for pre and post processing of GiD and PAK-S solver. Developing this interface we get a very powerful tool for solving different kinds of problems of structure strength analysis. The interface is the basis for the further upgrade that can be applied in the usage of different fields in FEM such as: geomechanics, heat transfer, biomechanics, fluid flow and fluid-fracture interaction, etc.

REFERENCES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