Some extensions to W.Muellers

PROFI-USER-GUIDE

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A. General remarks

The program PROFI (version V5.2) which has been obtained from Prof.W.Mueller, T.H.Darmstadt, was installed by W.Remmer under CERNVM (IBM 3090-600; VM/XA; Fortran77). This release is the only version we are sure to work together with TBCI-SF, which means that it delivers the correct tables neccesary for the employment of TBCI-SF.

PROFI itself creats beside of some temporary files a meta-file (not GKS-format) which contains graphical output-data. The MAFIA-routines, included by W.Remmer, create a file with filetype ITABLE which can be converted to TBCI-SF format /8/.

For an earlier version of this program a user's guide is available in german /1/. Futhermore T.Tortschanoff has written some preliminary notes on the use of PROFI /2/. Nevertheless, it is difficult to operate the release V5.2 of the program without getting into trouble since several changes of the code took place and V5.2 still is not free of errors. An up-to-date documentation for this release does not exist.

This note does not intend to be a transcription of /1/ but should discribe all so far known departures from /1/ or /2/ (part B). Then a short description of the errors of PROFI V5.2 is given, followed by instructions for error handling (part C). For some cases, examples were computed by PROFI to show the influence of these errors on the results. An explanation of the correspon-ding output-files is given in part D. If you do not have any experience with PROFI and just want to get an idea about its output then leave out parts B and C.

B. Supplement rules for creating the input for a PROFI-run

- the cards as described in /1/ are to be understood as lines of 72 characters of the sequential input-file ("fn DATA fm" under VM) used by PROFI; their formats are given by /2/;
- the input identification lines (like 'GITT' or 'MATE') must be completed each by an interger number in all cases where PROFI allows for different input-formats. (This normally occurs in connection with different geometries or simplification of input.) For example: in case of the mesh definition, there exit three different formats for the carts (lines) following "GITT". To identify the format one has to write GITT1, GITT2 or GITT3 in the identification line corresponding to the names given in /1/.
- because of the max. length of each line the format of all tables of exclusively floating-point-numbers in 'xxx.DATA' have to be changed. 8F10.5 is replaced by 6F10.5

- for the same reason the block-end-identifiers '998' and '999' must be written into the columns 70 to 72; '99' instead of '999' is also allowed; in contrast to older versions V5.2 expects an identification line with the contents 'ITER' in front of the iteration data;
- the upper limit for IOMAX is not given by the FORMAT-ident. (which is I5), but is a function of NNNMAX (same card/line); exceeding this limit leads to an unexpected error in routine PITE;

Ignoring the rules given before leads to several error-messages (not self-explaining at all) at run-time.
Futhermore the table of possible boundary conditions as a function of NGEO given at page PROG5/4 of /1/ is to be replaced by

NGEO	I1A	I1E	I2A	I2E	I3A	I3E
1	1,2	1,2	1,2,3,4	1,2,3,4	-	-
2	1,2,5	1,2	1,2,3,4	1,2,3,4	-	-
3	1,2	1,2	-	-	1,2	1,2
4	1,2	1,2	1,2,3,4	1,2,3,4	1,2	1,2
5	1,2,5	1,2	1,2,3,4	1,2,3,4	1,2	1,2

Since the establishment of the control data for iterartion requires experience, some tested examples are given :

1) Linear problems :

```
ITER
BSOR
    1
    1 1000    1.0E-7          50          0.          0.5
999
```

2) Non-linear problems :

```
ITER                                               ( proposal W.-R.Novender, /3/ )
BSOR
   30                 1 0.01
    1  200       0.05     0    50         0.0         0.5
   99  500     1.0E-7     0     0         0.0         0.0
999
```

```
ITER                                               ( proposal T.Tortschanoff, /2/ )
BSOR
   30                 1 0.01
    1   50       0.05     0    50         0.0         0.5
    5   50       0.05     0    50         0.0         0.5
   10   50       0.05     7     0         0.0         0.0
   30  500    0.00005     0     0         0.0         0.0
999
```

C. Errors

- since the automatic toggeling of the method of iteration does not work correctly, it is neccesary to choose always 'BSOR' in the iteration-data-block (/1/, page PROG5/25);
- PROFI provides three types of boundary conditions (/1/, page THEO4/1); the third type (to prescribe the values of the unknown quantity or their deviation at inner mesh points) produces wrong results; this problem can be overcome in almost all cases by using the second kind of boundary conditions ('virtual materials');
- depending on one of the parameters to be transmitted when calling the PROFI-operator DRUCK (operator here is the name for some special subroutines in the PROFILIB library, see /1/) some pointers are unintentionally changed during run-time; in case of NSYS = 1,2 this leads to the production of a faulty ITABLE-file by the MAFIA-routines; to overcome the problem always do all MAFIA-calls before any call to DRUCK within the main-program;

D. Examples

Some basic examples for PROFI-runs exist under CERNVM, too. The files are denoted "PR-* DATA" which contains the input-data,
"PR-* EXEC" the batch command file,
"PR-* FORTRAN" the PROFI-main program and
"PR-* OUTPUT" the results of the run.
Here '*' is a wildcard to be substituted by :

```
DC    : the calculation of electrostatic fields of the CTF-
      : DC-gun; run free of errors;
SYNG  : an example given in /1/; run free of errors;
CAP1  : the  calculation of electrostatic fields of a con~
      : denser; run free of errors;
CAP2  : same as CAP1, but different boundary conditions; run
      : free of errors;
CAP3  : a condenser, where the poles are given by boundary
      : conditions type 3; demonstrates error-2;
COIL1 : calculation of magnetostatic fields of a solenoid;
      : run free of errors;
COIL2 : same as COIL1, but different boundary conditions;
      : no run-time error is generated, but the choosen boundary
      : conditions lead in this case ( NSYS=1 ) to wrong results;
      : in case of NSYS=4, the same boundary conditions are
      : allowed, as shown by example CAP1;
LOOP3 : calculation of magnetostatic fields of a single
      : current-loop; mesh with cylindrical symmetry; run
      : free of errors;
LOOP1 : example with the same input-data as in case of LOOP3,
      : but no cylindrical symmetrie of the mesh, this means
      : that PROFI calculates the magnetostatic fields of a
      : infinitly long conductor; run free of errors;
```

The files are stored in the VM-archieve-system and can be asked from W.Remmer or J.Stroede (PS/LP).

E. References

/1/ Das Programmsystem PROFI; W.Mueller, (10/80);

/2/ Preliminary notes on the use of the programme PROFI for the computation of 3D magnetic fields; T.Tortschanoff, CERN internal note; ISR-BOM/TT/ml, (12/81);

/3/ private communication, W.-R.Novender;

/8/ 'PROFICNV', Note PS/LP 89-38; J.Stroede, (10/89);

F. References not quoted in this note

/4/ Numerical solution of 2- or 3-dimensinal nonlinear field problems by means of PROFI; W.Mueller et.al.; Archiv fuer Elektrotechnik 65, (1982), 299-307;

/5/ 3dimensinonale Magnetfeldmessungen und -Berechnungen an den Prototypen der HERA Korrekturdipole; U.Berghaus, W.-R. Novender; DESY report M-86-09;

/6/ Computer aided two/three dimensional magnet design by means of PROFI; W.-R.Novender; DESY-report 87-118;

/7/ The 2D/3D static nonlinear field program PROFI at DESY (PROFCOM user's guide); W.-R.Novender; DESY-report M-88-02;

G. Acknowledgement

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