

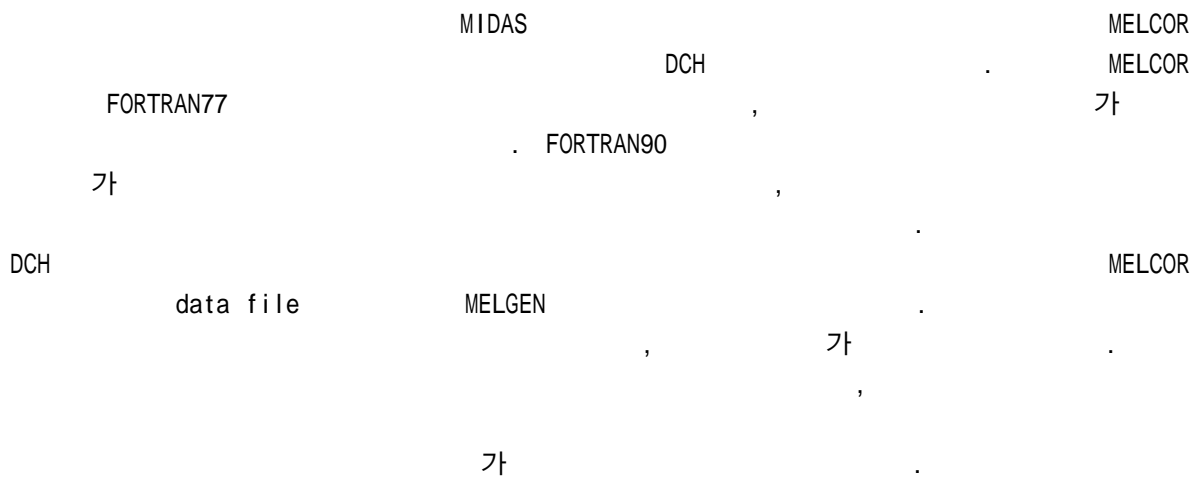
(MIDAS)

DCH

## A Restructuring of DCH Package for MIDAS Computer Code

\* , , ,

150



### Abstract

DCH package, which is one of thermal-hydraulic packages in MELCOR, has been restructured for the MIDAS computer code. MIDAS is being developed as an integrated severe accident analysis code with a user-friendly graphical user interface and modernized data structure. The data structure of the current MELCOR code using FORTRAN77 causes a difficult grasping of meaning of the variables as well as waste of memory. New features of FORTRAN90 make it possible to allocate the storage dynamically and to use the user-defined data type, which lead to an efficient memory treatment and an easy understanding of the code. Restructuring of the DCH package addressed in this paper includes module development, subroutine modification, and treats MELGEN, which generates an initial data file, as well as MELCOR, which is processing a calculation. The results of the modified code are verified against those from the existing code. As the trends are similar to each other, it hints that the same approach could be extended to the entire code package. It is expected that code restructuring will accelerate the code domestication thanks to direct understanding of each variable and easy implementation of modified or newly developed models.

1.

MELCOR MIDAS  
 MELCOR 가  
 , 가  
 , 가  
 FORTRAN90 가  
 가 data type .[1,2,3]  
 , (readability) (DMM)  
 , 가 subroutine (derived type variables) [4,5].  
 [6,7,8,9],  
 ) DCH ( , MELCOR  
 restart file MELGEN ,

2.

MELCOR code 3 restart file  
 MELGEN, restart file , log file plot file  
 MELCOR, PLOT  
 COR, HT, SPR, TF, DCH, RN2 20  
 가 , data ,  
 subroutine , message subroutine, code  
 subroutine subroutine [10].

### 2.1 Restart file

data MELCOR  
 RESTART file read write subroutine MXXRS MXXRSW ,  
 read write  
 real, integer, logical, character 4 array

### 2.2 Database

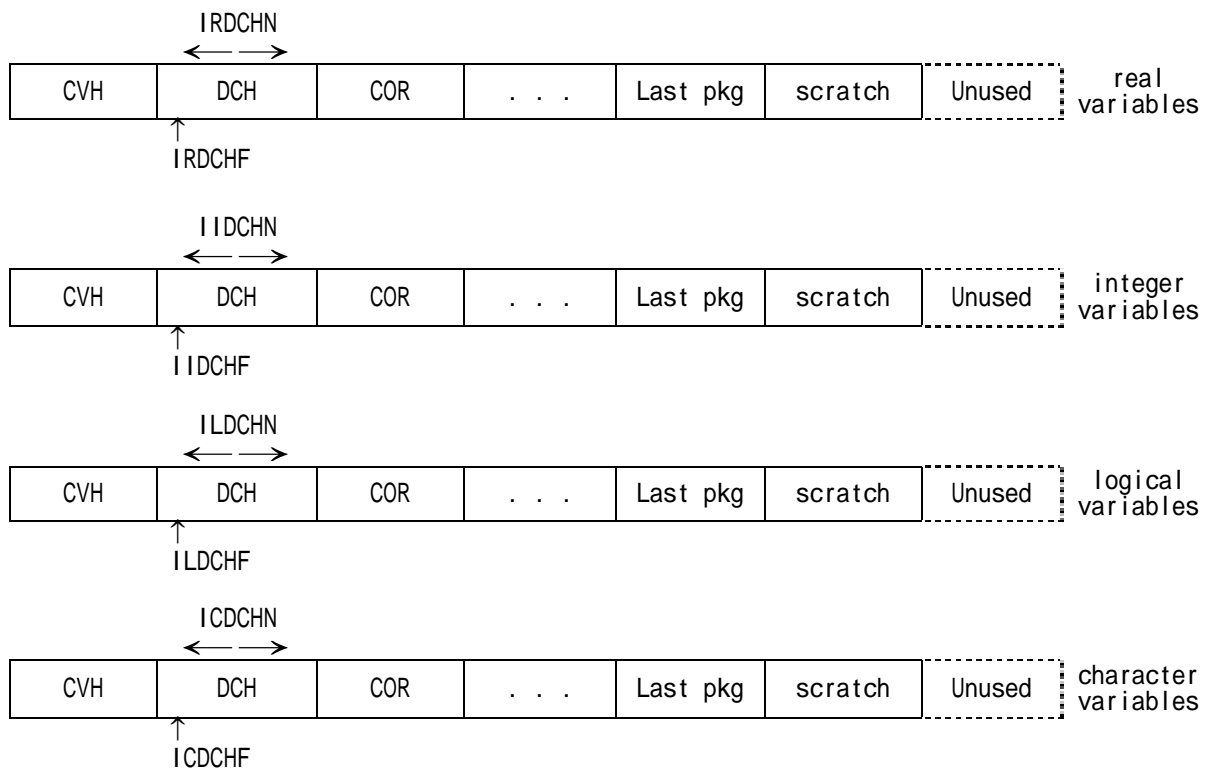
MELCOR data 4가  
 [8,9,11].  
 , database 2  
 [8,9,11]. Database 1 array  
 array argument . Database 2

Database argument array argument .

### 2.3

subroutine DCHDBD subroutines database subroutine DCHDBC  
 comment argument pass . DCH

(1) DCH 1  
 1  
 subroutine 'DCHDB' common block ( 1),  
 type 2 ( 2), 4 data



1. 1

```
* - INCLUDE DCHDB
C
C     COMMON WITH POINTERS TO BEGINNING OF DECAY HEAT DATA BASE
C
C     COMMON /DCHDB/  IRDCHF , IRDCHN , IIDCHF , IIDCHN ,
1     ILDCHF , ILDCHN , ICDCHF , ICDCHN
* -
```



3.

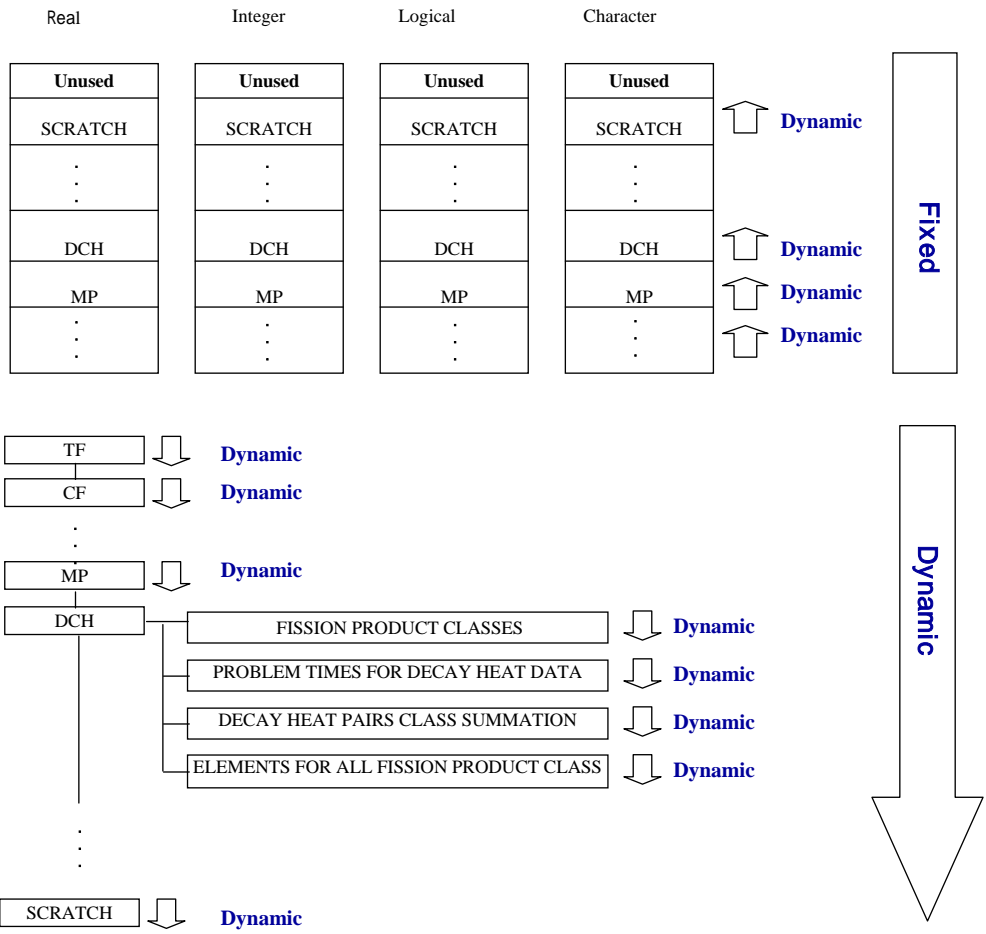
restart file MELGEN /  
 , restart file MELCOR

MELCOR 1.8.4

FORTRAN90  
 가

MELCOR (derived data type) FORTRAN90

4



4.

DCH , DCH  
 subroutine, DCH 80 subroutine DCH MELCOR

subroutine 130 , (MELtoMID)  
subroutine [4,5].

3.1

Subroutine DCHDB1, DCHDB2, DCHDB3, DCHDBE, DCHDBC, DCHDBT , subroutine DCHDBZ,  
DCHDBY, DCHDB4, DCHDBF, DCHDBD, DCHDBU ,  
subroutine DCHPS2, DCHDB5, DCHEDT, DCH3PT  
(local variable) . 2 DCH  
5 .

3.2 Subroutine

Subroutine [8,9] FORTRAN77  
MELCOR FORTRAN90 , 가  
[11].  
DCH subroutine , argument가  
subroutine 30 , subroutine  
subroutine local variable argument  
dimension array member variable  
1 .

```

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
MODULE DCH_MDL
!
! ***** DECAY HEAT GLOBAL DATA *****
INTEGER :: NDFPCL, NDELEM, NDDCTM, NDTDAL, &
           NFPCLS, NELEMS, NDCTIM, NTDALL, NDCH_FLAG
!
! ***** DCH : NUMBER OF FISSION PRODUCT CLASSES *****
TYPE DCH_C1 ; SEQUENCE
CHARACTER(LEN=32) :: FPCNAM
INTEGER :: IFPCID, ICLEPT, NCLELM, ITIMDH, LTIMDH
REAL :: CLSMAS, CLSPWB, CLSPWE, CLSPWO, CLSPWN
END TYPE
TYPE (DCH_C1), ALLOCATABLE :: DCH_CL(:)
!
! ***** DCH : NUMBER OF PROBLEM TIMES FOR DECAY HEAT DATA *****
TYPE DCH_T1 ; SEQUENCE
REAL :: DECHET, DECTIM
END TYPE
TYPE (DCH_T1), ALLOCATABLE :: DCH_TM(:)
!
! ***** DCH : DECAY HEAT PAIRS CLASS SUMMATION *****
TYPE DCH_T2 ; SEQUENCE
REAL :: TMDHAL
END TYPE
TYPE (DCH_T2), ALLOCATABLE :: DCH_TMP(:)
!
! ***** DCH : NUMBER OF ELEMENTS FOR ALL FISSION PRODUCT CLASS ***
TYPE DCH_E ; SEQUENCE
CHARACTER(LEN=2) :: CLSELM
END TYPE
TYPE (DCH_E), ALLOCATABLE :: DCH_EL(:)
!
END MODULE DCH_MDL
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

```



```

<> subroutine DCHCFE

      SUBROUTINE DCHCFE(
1     TIME, IFPCID, CLSMAS,
3     NDFPCL,
4     NFPCLS,
5     TOTPOW)
C
      . . . . .

      TOTPOW = 0.0D0
      IF (NFPCLS .GT. 0) THEN
C         POWER FROM FISSION CLASS
          DO 2001 ICLS = 1, NFPCLS
              TOTPOW = TOTPOW + DCHCLS(IFPCID(ICLS), TIME) * CLSMAS(ICLS)
2001      CONTINUE
C
          ENDIF
C
          RETURN
          END

<> subroutine DCHCFE

      SUBROUTINE DCHCFE (TIME,                               TOTPOW)
!     SUBROUTINE DCHCFE (TIME, IFPCID, CLSMAS, NDFPCL, NFPCLS, TOTPOW)
!
      USE DCH_MDL
      . . . . .
!
      TOTPOW = 0.0D0
      IF (NFPCLS.GT.0) THEN
!         POWER FROM FISSION CLASS
          DO 2001 ICLS = 1, NFPCLS
!! NOTICE: Converted by MELtoMID
!             TOTPOW = TOTPOW + DCHCLS (IFPCID (ICLS), TIME) * CLSMAS (ICLS)
!             TOTPOW = TOTPOW + DCHCLS (DCH_CL(ICLS)%IFPCID, TIME) *      &
!                                   DCH_CL(ICLS)%CLSMAS
2001      END DO
!
          ENDIF
!
          RETURN
          END SUBROUTINE DCHCFE

```

### 7. Subroutine DCHCFE

```

      DCH data DCH          RN1(8 subroutine)
, subroutine

```

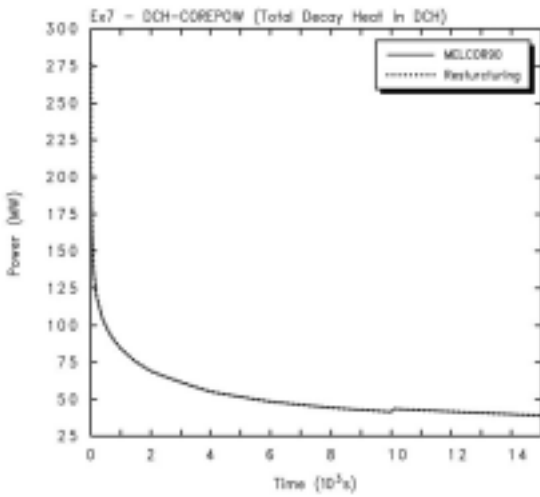


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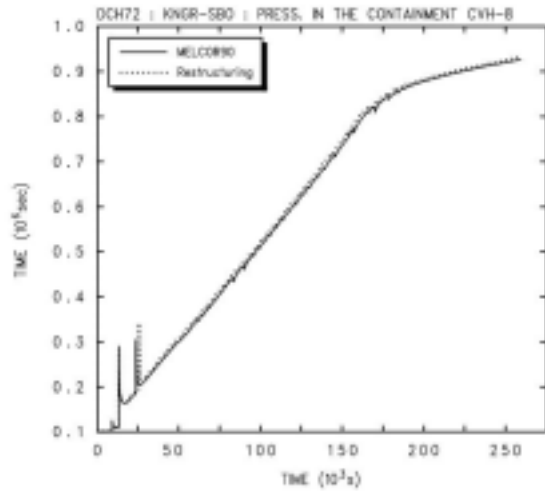
```

                                FORTRAN90
DCH                                FORTRAN77                                MELCOR                                FORTRAN90
                                ,
                                library
                                .
                                FORTRAN90                                MELCOR                                MELCOR
                                DCH
4300MWt  PWR type                                가                                SBO                                72
                                15,000
                                , FORTRAN90                                MELCOR
DCHMELCOR                                DCH                                . MELGEN
MELCOR                                subroutine                                data file(restart
file)  read/write                                . MELGEN                                restart file  write가
                                , MELCOR                                data file(restart file)  read                                , DCH
                                .
                                data file(restart file)  read/write
                                .
                                8                                11                                .                                8                                10
                                가                                .                                9                                dome                                20000
                                .
                                11
                                (delta time)

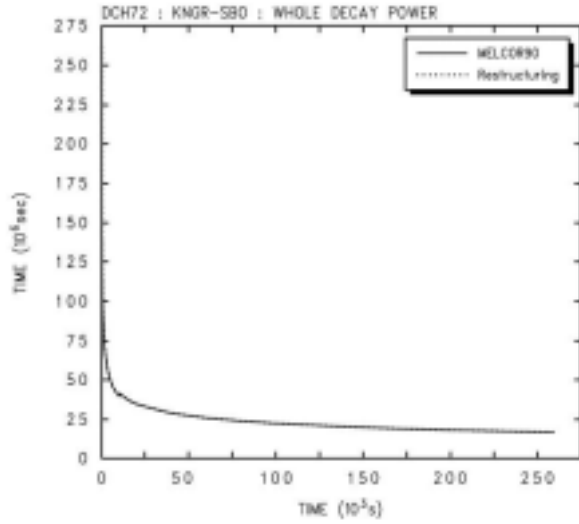
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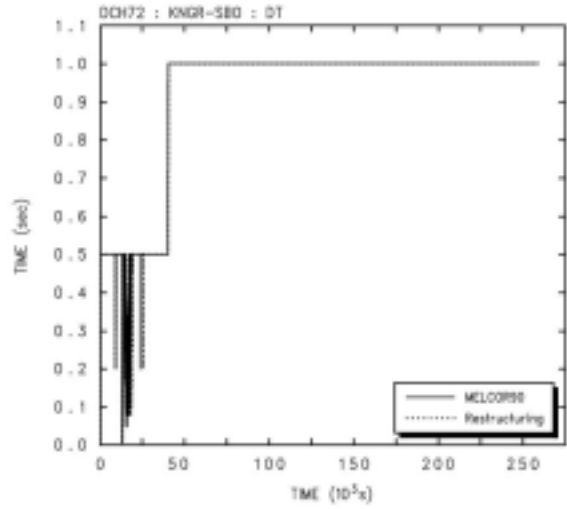
8.  
( )



9. Dome  
(SBO )



10. (SBO )



11. (SBO )

graph , DCH , event , BH, COR, ESF, HS  
 double precision single precision  
 (dt) (dt)  
 가 DCH CPU time array  
 / even/odd cycle

5.

MIDAS , DCH MELCOR  
 DCH , DCH , DCH  
 DCH , DCH  
 , Graph  
 ,  
 benchmarking problem set  
 MELCOR code /  
 DCH  
 [12],  
 가

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