ALPHAD Version 2.0d

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This program calculates the alpha hindrance factors and theoretical half-lives and, for even-even ground state to ground state transitions, R_0 using Preston's spin-independent equations. (M.A. Preston. Phys. Rev. 71, 865 (1947)).

The program reads an ENSDF-formatted file and produces a report of the hindrance factors, theoretical half-lives, and R_0's calculated by the program. This report will also summarize any problems encountered or assumptions made. There is also an option to produce a new file using containing the HF's calculated. R_0's may be specified on an ALPHA comment record by “HF” in columns 10 and 11 and a dollar sign (“$”) in column 12 or blanks in columns 12 through 19. The first value and uncertainty in columns 20 through 80 preceded by an R (“ R”; case insensitive) and an equal sign (“=”) or approximate sign (“ AP “) will be taken as R_0.

Input file: Sample: alphad.inp

Output files:

1. Report of calculations
   Sample output: alphad.rpt
2. New ENSDF file containing the hindrance factors (HF's) calculated by the program.
   Sample output: alphad.new

Terminal dialog:

1. Input data file (Default: alphad.inp):
2. Output report to file (Y/N):
   The default is “Y”. If No is answered, the report will be displayed on the terminal. If Yes is answered, the following query will appear: Output report file (Default: alphad.rpt):
3. Echo input (Y/N): The default is "Y". In this case the input file will be copied to the report file.
4. Rewrite input with hindrance factor (Y/N): The default is “Y”. If Yes is answered, the following query will appear: Output data set file (Default: alphad.new):

If the report output is to a file, the terminal output will note the progress in the calculations and report warning messages.

Command line mode:

The program may also invoked *via* the command line by entering alphad followed by a string with a leading per cent sign ("%") and the input parameters in the same order as in the terminal dialog separated by "%". A blank (" ") or "#" specifies that the program default be used. For output files, "null" (case insensitive) will direct the output to the null device (/dev/null under Linux). A simple example is:

alphad <*ENSDF filename*>

This will process in the specified ENSDF file with the program defaults.

Compilation and loading instructions:

This program requires subroutines from the NSDFLIB95 package.

Additional notes:

1. Calculation of DR0:
   Five values are calculated: R0(T,E), R0(T+DT,E), R0(T-DT,E), R0(T,E+DE), and R0(T,E-DE). DR0=SQRT(((ABS(R0(T+DT,E)-R0(T-DT,E)))/2)**2 + ((ABS(R0(T,E+DE) - R0(T,E-DE)))/2)**2). R0 and DR0 as calculated are output in the report file and so are R0(T+DT,E), R0(T-DT,E), R0(T,E+DE), and R0(T,E-DE).
2. If either the value or the uncertainty for E(parent), Q_α, or E(level) is non-numeric and E_α and ΔE_α are numeric, E_α and ΔE_α are used in the calculations.
   NOTE: For systematic uncertainties in Q_α from the Audi-Wapstra Mass Tables, the input data should be modified to use the estimated uncertainty and the new output edited to change DQP back to "SY".
3. If there is more than one non-numeric uncertainty involved, the order of precedence is limits (*e.g.*, "GT" or "LT") and then "AP", "CA", and "SY" for the new output.

Additional documentation:

None.

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Version History:

1		As received from NDP/ORNL
1.1	29-Jun-1987	Converted from Fortran 63 to Fortran 77 (yako)
1.2	27-May-1988 (AHF) (AHFYE)	1. VAX version by Richard C. Ward, C&TD TA Physics, ORNL, 574-5449 2. Date of VAX Version 1.2 is 5/27/88 3. Corrected 5/27/88 to check for presence "A" card before doing calculations.

1.2	21-Apr-1993	1. Explicitly typed all variables and functions 2. Delinted using FLINT 2.83 3. Added MDC coding (TWB)
1.3	1-Apr-1994	1. Merged version 1.2 (21-Apr-93) of ALPHAD and version 1.2 (27-May-88) of AHF (AHFYE) written by Richard C. Ward C&TD TA Physics, ORNL 2. Updated masses to data in Audi and Wapstra, Nucl. Phys. A565, 1 (1993) (Approved by YA) 3. Allow for more than 16 characters when getting R0 (as per discussion with YA) 4. Added bounds checks for arrays 5. Added check on parent energy for even-even parents 6. Added checks for non-numeric parent and level energies 7. Corrected logic for outputting new data set 8. Implemented "$" formalism for COMMENTs 9. Calculated uncertainties on RZERO and HF 10. Changed most arrays from DOUBLE PRECISION to REAL 11. Do not output in new file HF if no IA (TWB)
1.3a	29-Aug-1994	1. Always output two digits in uncertainty for R0 2. Output calculated R0 for T+DT, T-DT, Q+DQ, and Q-DQ 3. Separate data set reports by two lines (As per discussions with YA after testing version 1.3. TWB)
1.4	30-Sep-1994	1. Reworked handling of uncertainties a. Retained information on non-numeric uncertainties and output for new HF's (See new subroutine CHKNON) b. If DBR is GT or GE and BR>=0.8, BR=(1.0+BR)/2., DBR=(1.0-BR)/2. c. If DBR is LT or LE and BR<=0.2, BR=DBR=BR/2. d. If no DIA and IA not equal to 1, no DHF given e. If no DHF or only one-character DHF and HF is E formatted, expand. 2. Suppressed output of non A DECAY data sets even if echo is on 3. Added progress and messages to TTY output (TWB)
1.5	08-Apr-1996	1. Corrected output overflows in T1/2 and HF fields of report 2. Ignore uncertainty on E(level) if none for QP or E(parent) - use E(alpha) if given and DE(alpha) nonzero 3. Updated alpha atomic mass to 1995 Update to the Atomic Mass Evaluation 4. DHF truncated in some places - corrected (TWB)
1.5a	09-Apr-1999	1. Y2K modifications 2. Improved ANSI FORTRAN 77 compliance 3. Corrected substring range errors in outputting HF

		4. Check for and skip Ionized Atom datasets 5. Added coding to get R0 from rich text comments (TWB)
1.6	07-Feb-2001	Added UNX MDC coding. (RRK)
2.0	24-May-2004	C.L. Dunford 1. Converted to Fortran 95 2. Command line input added
2.0a	06-Nov-2006	T.W. Burrows 1. Corrected error which caused erroneous error message on second R0 found Restored Title and version information to terminal dialogue 2. Cosmetic cleanup of error messages 3. Updated alpha mass and 1 amu to 2003 AME
2.0b	01.06.2017	T.D. Johnson 1. Do not report HF in report of multiple branch alphas with no intensity. 2. Fixed bug where odd-even checks from parent card not used when getting radius from HF comment. 3. Fixed partial half life bug.
2.0c	12.07.2017	T.D. Johnson and Balraj Singh 1. Fixed issue with unplaced alpha cards. 2. Do not report partial half-lives for alpha with no intensity
2.0d	21.11.2020	Sukhjeet Singh, Sushil Kumar and Balraj Singh 1. Fixed bug pertaining to abundance 1.0 for alpha's without Intensity 2. Updated to read the official symbols for the super-heavy elements (Z = 112-118) in an ENSDF-formatted file

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