



Westinghouse

No: WANL-TMI-699

Date June 13, 1963

From J. M. Ravets, Reactor Analysis

Subject Comparison of Group Constants
Calculated Using P1MG and
MUFT

ASTRONUCLEAR LABORATORY

TO: Nuclear Design
Nuclear Analysis

cc: F. D. Retallick
J. G. Gallagher
W. H. Arnold
W. Jacobi
D. W. Drawbaugh
C. P. Saalbach
C. A. Stevens
D. Doncals
R. W. Dannels (APD)
W. Eich (APD)
H. C. Woodsum

MASTER

NOTICE
This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

PROBLEM

Verify that the multigroup code P1MG and its associated library yield, for a flat flux problem, the same few group constants as the MUFT fast constant code.

CONCLUSIONS

Analysis indicates that the P1MG code (Nuclear Design Manual, Section 30) when used with library tape 784* will yield the same few group constants as the MUFT code using tape 715 and the self-consistent P-1 approximation. Since the SDM (Nuclear Standard Design Method) - see RA-049, Addendum 2 - uses MUFT with tape 715, consistent multi-group problems should employ P1MG with tape 784.

DISCUSSION

P1MG Library

The 50 fast group version of P1MG in use by Reactor Analysis is currently run using tape 533.** Recent investigations of the use of P1MG fast constants (P1MG uses

* Tape 784 at East Pittsburgh is referred to as tape 1B17 at WANL.

** Tape 533 is identical to MUFT tape 715 except that tape 715 does not include two experimental forms of &-238, elements 89 and 90, found on tape 533. The tape 533 library is described in TMI-616. Further, P1MG tape 533 does not contain element 73, Ta, which does appear on MUFT tape 715.

DISTRIBUTION OF THIS DOCUMENT UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

the P-1, consistent Grueling - Guertzel approximation) has uncovered an error in the output statement of tape 533: the edit 5 value of $\nu \Sigma_f$ in group 3 is incorrectly listed, being too low. The same error appears in $\nu \Sigma_f$ in edit 3. All other constants, as well as fluxes and eigenvalue are unaffected by this output error. See Table I.

The same library (567 Ref. WCAP 3709) as used to generate tape 533 was used to generate tape 784. A comparable problem run with tape 784 gave identical answers as when run using tape 533, except that $\nu \Sigma_f$ in group 3 differed, being higher using tape 784. Comparison with MUFT shows that tape 784 is correct. See Table I.

P1MG - MUFT Comparisons

In order to compare P1MG calculated group constants with those obtained from MUFT (requesting the P-1, consistent G-G approximation) it is necessary to run two 3-point P1MG problems. These will be referred to as the "flat flux" and "good current" problems. The "flat flux" problem yields the same 1-point model as used by MUFT. The "good current" scheme forces the calculation to give D values close to MUFT.

Flat Flux Problem

- a. Use number densities of materials in the one region.
- b. Geometry is 3-point* cylindrical cell (i.e., choose boundary conditions for 0 net current across region boundary, as well as at center of cell:
 $C_l = C_r = 0$).
- c. Mesh spacing is arbitrary; use, say 1 cm.
- d. Set both the total and resonance buckling equal to the buckling used in MUFT.

*Center point is 0, hence enter 2 for number of points on the input sheet.

- e. Set the x-direction buckling equal to the square root of the total buckling.

The y-direction buckling is set equal to 0.

Good Current Problem*

- a. Use number densities of materials in the one region.
- b. Geometry is a 3-point slab region. Set the flux equal to 0 on both boundaries: $C_l = C_r = 704$.
- c. The mesh spacing, h , must be found from
$$h^2 = 2/B_{\text{resonance}}^2$$
- d. Set the resonance buckling equal to the buckling used in MUFT.
- e. All other buckling values are set equal to 0.
- f. Run problem for 1 iteration only.

As can be seen from Table I the "flat flux" scheme gives agreement with MUFT on all constants but D. The values of D obtained from the "good current" scheme are very close to those obtained from MUFT, but not identical. Indeed, P1MG calculated D differently than did MUFT; P1MG treats anisotropic scattering in graphite differently than MUFT. This problem is currently under investigation and will be dealt with in a future report.

SIGNED 
J. M. Ravets, Nuclear Analysis

* The procedure used was obtained in personal communication with R. Dannels (APD) on April 5, 1963.

TABLE I - MUFT - P1MG COMPARISONS

Group	Code	Tape	Σ_r	Σ_a	$\nu\Sigma_f$	D
1	P1MG	533 ⁽¹⁾	.0202788	.00072528	.001817219	.079577
	P1MG	533 ⁽²⁾	.017798	.00072594	.00183536	2.81995
	P1MG	784 ⁽³⁾	.017798	.00072594	.00183536	2.81995
	MUFT	715	.020181	.000725	.001818	2.70828
2	P1MG	533 ⁽¹⁾	.0075489	.00155158	.0027697	.079577
	P1MG	533 ⁽²⁾	.00568396	.00137642	.0025142	1.24438
	P1MG	784 ⁽³⁾	.00568396	.00137642	.0025142	1.24438
	MUFT	715	.007546	.001551	.002769	1.25155
3	P1MG	533 ⁽¹⁾	.000654766	.01124639	.0124363*	.680164
	P1MG	533 ⁽²⁾	.00065294	.0112021	.012366	1.0657
	P1MG	784 ⁽³⁾	.00065294	.0112021	.015446	1.0657
	MUFT	715	.000654	.01124	.015508	1.078980

(1) Flat flux problem

(2) Good current problem

(3) Good current problem

* The value of $\nu\Sigma_f$ in Group 3 using Tape 784 with a flat flux problem is 0.015514. All other constants are identical to those from Tape 533 with a flat flux problem.