10. Machine Requirements: no special hardware requirements.
11. Material Available: ITS is disseminated through the Radiation Shielding Information Center at Oak Ridge National Laboratory. In addition to documentation and the input and output from sample problems, the package includes the four basic elements of the system:
    1. XDATA: the electron/photon cross-section data file
    2. XGEN: the cross-section generation program file
    3. ITS: the Monte Carlo program file
    4. UPEML: a machine-independent UPDATE emulator.
12. Acknowledgment: This work was sponsored by the U.S. Department of Energy.
13. *References:*

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[2]M. J. BERGER and S. M. SELTZER, "Computer Code Collection," CCC-107, Radiation Shielding Information Center, Oak Ridge National Laboratory (June 1968).

TEMPS

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1. Program Name and Title: TEMPS, The Evaluation of the One-Group Time-Dependent Neutron Transport Flux in Infinite Media.
2. Description of Problem Solved: The code numerically determines the scalar flux as given by the one-group neutron transport equation with a pulsed source in an infinite medium. Standard plane, point, and line sources are considered as well as a volume source in the negative half-space in plane geometry. The angular distribution of emitted neutrons can either be isotropic or monodirectional (beam) in plane geometry and isotropic in spherical and cylindrical geometry. A general anisotropic scattering kernel represented in terms of Legendre polynomials can be accommodated with a time-dependent number of secondaries given by $c(t) = c_0(t/t_0)^\beta$ where $-1 < \beta < \infty$. The code is designed to provide the flux to a high degree of accuracy (4 to 5 digits) for use as a benchmark to which results from other numerical solutions or approximations can be compared.
3. Method of Solution: A semianalytic method of solution is followed. The main feature of this approach is that no discretization of the transport or scattering operators is employed. The numerical solution involves the evaluation of an analytical representation of the solution by standard numerical techniques. The transport equation is first reformulated in terms of multiple collisions with the flux represented by an infinite series of collisional components. Each component is then represented by an orthogonal Legendre series expansion in the variable x/t where the distance x and time t are measured in terms of mean-free-path and mean-free-time, respectively. The moments in the Legendre reconstruction are found from an algebraic recursion relation obtained from a Legendre expansion in the direction variable μ. The multiple collision series is evaluated first to a prescribed relative error determined by the number of digits desired in the scalar flux. If the Legendre series fails to converge in the plane or point source case, an accelerative transformation, based on removing the singular portion of the flux (near the wave front), is applied. The scattering kernel
$$g(\mu' \to \mu) = \frac{L+1}{2^L}(1 \pm \mathbf{\Omega}\cdot\mathbf{\Omega}')^L$$
is supplied to test the anisotropic scattering option. In addition, fission is accommodated in the isotropic scattering component.
4. Related Material: No additional programs are required other than a plotting routine. A plot file can be generated in a format compatible to standard plotting packages.
5. Restrictions: The number of desired flux calculations, anisotropy of the scattering kernel, and computational accuracy are limited only by the computer storage available through the use of dynamic storage allocation. The largest time t allowed is limited by the greatest floating point number allowed according to
$$c_0(t/t_0)^\beta t/(1+\beta) < \text{largest floating point number} \ .$$
For $x/t \cong 1$ and a beam source, the Legendre series may not converge to the accuracy desired as a result of its poor representation at discontinuities.
6. Special Features of Program: The Legendre flux moments can be stored and read from the stored file to avoid unnecessary recalculation.
7. Computers: The code was developed on a CYBER 175 and is currently being modified for a VAX-11/780.
8. Running Time: The computational time required is problem dependent and therefore cannot be easily specified. As an example, consider a case where the flux is desired to four-place accuracy at 23 time points and 5 space points for an isotropic scattering kernel. The computational time for this case is <2.5 s on a CYBER-175 or ~0.012 s per time and space point.
9. Machine Requirements: None.
10. Programming Language: FORTRAN IV.
11. Operating System: NOS BE CDC/CYBER 175.
12. Additional Programming Information: The code is written in a modular format with 15 subroutines and ~1200 lines of coding.
13. Material Available: The code and documentation may be obtained from the Argonne Software Center, Argonne National Laboratory, or from the author.
14. *Acknowledgment*: This work was partially completed under the AFOSR contract #S-4-77486.
15. *Reference:*

[1]B. D. GANAPOL, *Proc. Int. Mtg. Advances in Nuclear Engineering Computational Methods*, Knoxville, Tennessee, April 9-11, 1985, p. 696, American Nuclear Society (1985).