NOTE ON THE EQUATION OF HEAT CONDUCTION*

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1. *Introduction.* In recent years, operational methods in mathematics have been a subject of much discussion. Heaviside, in his papers, by somewhat artificial methods, succeeded in solving a number of differential equations, especially those common to the electro-magnetic theory. The newer developments in operational calculus make no attempt to follow Heaviside's methods. More recent literature shows that the Fourier integral (Jeffreys,† Bush‡) plays an important role in these methods. In a thesis of Levinson,§ it was demonstrated that the Fourier transform could be employed to even better advantage than the Fourier integral.

In this note, it is proposed to quote the Fourier transform theorem of several variables, and apply a particular form of it to the solution of the equation for the flow of heat in three dimensions.

2. *Fourier Transform of Several Variables.* Here we shall consider a function of k real variables $F(x_1, \cdots, x_k)$ in a closed domain $a_\lambda \leqq x_\lambda \leqq b_\lambda$, $(\lambda = 1, \cdots, k)$, capable of taking on complex values. Consider an integral with infinite limits, such as

$$\int_{-\infty}^{\infty} \cdots \int_{-\infty}^{\infty} F(x_1, \cdots, x_k) dx_1 \cdots dx_k.$$

Such an integral is said to be convergent if the limit of the integral

$$\lim_{A_\lambda \to \infty, B_\lambda \to \infty} \int_{-B_1}^{A_1} \cdots \int_{-B_k}^{A_k} F(x_1, \cdots, x_k) dx_1 \cdots dx_k, \quad (\lambda = 1, \cdots, k),$$

* From a thesis presented for the degree Master of Science at the Massachusetts Institute of Technology, Oct. 30, 1934, under the title *Applications of the Fourier transform theorem.* Presented to the Society, December 28, 1934.

† H. Jeffreys, *Operational Methods in Mathematical Physics,* Cambridge Tract No. 23, 1931.

‡ V. Bush, *Operational Circuit Analysis,* 1929.

§ N. Levinson, *Applications of the Fourier integral,* master's thesis, May, 1934, Massachusetts Institute of Technology, unpublished as yet.