Some results of Watson, Plancherel type integral transforms related to the Hartley, Fourier convolutions and applications

Tuan Trinh¹

¹Electric Power University

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Abstract

In this work, we study the Watson-type integral transforms for the convolutions related to the Hartley and Fourier transformations. We establish necessary and sufficient conditions for these operators to be unitary in the L 2 (R) space and get their inverse represented in the conjugate symmetric form. Furthermore, we also formulated the Plancherel-type theorem for the aforementioned operators and prove a sequence of functions that converge to the original function in the defined L 2 (R) norm. Next, we study the boundedness of the operators (T k). Besides, showing the obtained results, we demonstrate how to use it to solve the class of integro-differential equations of Barbashin type, the differential equations, and the system of differential equations. And there are numerical examples given to illustrate these.

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