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On the equivalence between wave equations and functional differential equations

The earliest connection between hyperbolic PDEs and functional equations was perhaps the d'Alembert solution formula. Solving various wave equations by the method of characteristics leads to equivalent functional differential systems, often neutral differential equations or integral delay equations.

In recent decades, this perspective has been useful in control of PDEs, applying results on stabilization of delay systems. Furthermore, the time delay inherent in the transmission of electromagnetic and gravitational waves allows for the asymptotic study of such systems as neutral equations.