



**Iran University of Science and Technology
Mechanical engineering Department**

**Analytical Solution of non-Fourier Differential
Equation for Unsteady Temperature Field within a
hollow sphere under Harmonic Boundary Condition**

**A Thesis Submitted in Partial Fulfillment of the Requirement for the
Degree of Master of Science in Mechanical engineering**

By:

Amin Bahrami

Supervisor:

Dr. Gh. Atefi

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Abstract

Recently by developing engineering science and new technologies, applications which in them considering non-Fourier heat conduction is important, has increased. In this study analytical solution of the axisymmetric non-Fourier temperature field within a hollow sphere is investigated considering both single phase and dual phase lagging heat conduction equation. The solution is found for the most General linear time-dependent boundary conditions. Then a periodic boundary condition has been simulated with harmonic oscillation. The material is assumed to be homogeneous and isotropic with temperature-independent thermal properties. To solve the problem, first of all, the boundary condition is assumed to be a constant and by applying the method of separation of variables, the temperature distribution in a hollow sphere is obtained. Then by Duhamel's principle, the temperature field under a periodic boundary condition is determined. Also the problem for single phase lagging constitutive relation is solved numerically and a comparing for the result of both analytical and numerical solution will be given.