SOLUTION OF LAPLACE EQUATION BY DIFFERENTIAL TRANSFORM METHOD

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Abstract: The Laplace equation is a fundamental partial differential equation with wide-ranging applications in various scientific and engineering domains. In this research, we explore four distinct scenarios governed by the Laplace equation and devise methods to solve them effectively. To tackle these intricate situations, we employ the differential transform method (DTM), a powerful mathematical tool known for its ability to generate solutions that align closely with the underlying physical and engineering principles. By implementing the DTM, we delve into the analysis of these scenarios, each accompanied by either Dirichlet or Neumann boundary conditions. This choice mirrors real-world scenarios, enriching the practical relevance of our study. In this study, we discover that adjusting the parameters m and n can significantly enhance the accuracy of our solutions. We carefully fine-tune these parameters to strike a balance between computational efficiency and solution precision. Our code dynamically terminates based on the smallness of individual terms, signifying the convergence of the series to a sufficiently accurate result. Through systematic experimentation, we identify the optimal values for m and n that bring our solutions closest to the exact solutions. This empirical insight not only enhances the precision of our findings but also sheds light on the sensitivity of the DTM to parameter variations. In essence, our research not only provides solutions to Laplace equation-driven problems but also underscores the practicality of the differential transform method in solving complex issues with real-world implications. By emphasizing the role of parameter adjustment in optimizing solution accuracy, we contribute to the broader understanding of how mathematical techniques can be effectively harnessed to address practical challenges in physics and engineering. This study represents a significant step toward bridging the gap between theoretical mathematics and practical applications, highlighting the importance of precision and adaptability in mathematical modeling.

Keywords: Boundary conditions, Differential Transform Method, Dirichlet boundary condition, Laplace equation, Neumann boundary conditions, Partial Differential Equations, Two-Dimensional

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