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STUDY OF IMPROVED LUMPED PARAMETER IN TRANSIENT HEAT CONDUCTION

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ABSTRACT

In this paper, a study of improved lumped parameter in transient heat conduction is studied . This paper reviews the applications of transient heat conduction based on lumped parameter, improved lumped parameter analysis, transient heat transfer analysis by slab, method to analysis of transient, three dimensional transient heat conduction and other types of transient heat transfer. Mostly researchers used lumped parameter or improved lumped parameter to solve the transient heat conduction problem using either hermite approximation method or polynomial approximation method and compared to earlier method. From the review, it is concluded that no work is done in transient heat conduction of multidimensional in cylindrical shape with the help of lumped parameter using method of separation of variables.

Key words: Lumped, Heat, Conduction

INTRODUCTION

MODES OF HEAT TRANSFER

Heat transfer generally takes place by three modes such as conduction , convection and radiation. Heat transmission , in majority of real situations , occurs as a result of combinations of these modes of heat transfer. Conduction is the transfer of thermal energy between neigh boring molecules in a substance due to a temperature gradient . It always takes place from a region of higher temperature to a region of lower temperature, and acts to equalize temperature differences. Conduction needs matter and does not require any bulk motion of matter. Conduction takes place in all forms of matter such as solids , liquids , gases and plasmas . In solids, it is due to the combination of vibrations of themolecules in a lattice and the energy transport by free electrons . In gases and liquids, conduction is due to the collisions and diffusion of the molecules during their random motion. Convection occurs whenasystem becomes unstable and begins to mix by the movement ofmass. Radiationdescribesanyprocessinwhichenergyemittedbyo nebodytravelsthroughamedium or through space absorbed by another body. Radiation occurs in nuclear weapons, nuclear reactors, radioactive radio waves, infrared light, visible light,ultravioletlight,andX-rays substances.

Heat can be transferred by:

- Conduction
- Convection
- Advection
- Radiation

DISCUSSION

Based on the literature review, various solution methodologies used to obtain the temperature field . The objective of conduction analysis is to determine the temperature field in a body and how the temperature within the portion of the body. The temperature field usually depends on boundary conditions, initialcondition, material properties and geometry of the body. The solution of conduction problemsinvolves thefunctional dependence of temperature on space and time coordinate. Obtaining a solution means determining a temperature distribution which is consistent with the conditions on the boundaries and also consistent with any specified constraintsinternaltotheregion. Mostly researchers used either hermite approximation or polynomial approximation method with lumped parameter or improved lumped parameter to solve different transient heat transfer problems. The application in the field of lumped parameter and improved lumped parameter which is shown in tabulated form in table 1.

Table 1 application in the field of lumped parameter and improved lumped parameter

Apply Method	Author	Problem	Compared Method	Result
Based on lumped parameter	Campo and Villase	Transientradioactivecoolingofs mallspherical body	Distributed model	Comparedresults with distributed model
	Cheroto et al.	Heat and mass transfer during drying of moist capillaryporousmedia, using luikov's equations	Classical lumped system analysis	Comparedresults with classical lumped system analysis
	Alhama and Campo	Unsteady cooling of a long slab, using luikov's equations	Classical lumped system analysis	Comparedresults with classical lumped system analysis
Based on improved lumped parameter	Clarissaetal	Transientheatconductioninanu clearfuelrod, using hermite approximation method	Conventional lumped paremeter	Improvement results over the classical lumped parameter
	JianSu	Unsteadycoolingof a long slab, using hermite approximation method	Conventional lumped parameter	results closed to conventional method
	Su and Cotta	Transient heat transfer in nuclear fuel rod using hermite approximation method	Conventional lumped parameter	Transient response of fuel, claddingand coolant is analyzed
	Gesu at al.	Transientradioactive coolingof a sphericalbody using hermite approximation method	Conventional lumped parameter	compared to conventional method
	Keshavarzand Taheri	Transient one-dimensional heat conduction of slab/rod, using polynomial approximation method	Conventional lumped parameter	Betteraccuracy
	Pontedeiro etal	One-dimensionaltransientheatconduction in a heat generating cylinder, using Hermiteapproximations	Conventional lumped parameter	simulated with the help of MATHEMATICA software
	Gesu etal	Transient heat conduction in a slab, using Hermiteapproximations	Conventional lumped parameter	Compared with Lumpedmodel
	Tan et al.	Transient heat conduction of a wall, using Hermiteapproximations	Conventional lumped parameter	validated by conventional method
	AmitPrakash&Shahid Mahmood	Analysis of temperature variation with time for heat generated /natural convection cooling in spherical shape, using polynomial approximation method	Conventional lumped parameter	Compared with conventional method
	Amitprakash&shahid mahmood	Analysis of temperature variation with time for heat generated /natural convection cooling in spherical shape, using polynomial	Conventional lumped parameter	Compared with conventional method

		approximation method		
	Sahu et al.	transient heat conduction of multidimensional in rectangular shape, using separation of variables and polynomial approximation method	Numerical & analytical solution method	Compared with Numerical & analytical solution method

CONCLUSION

It is interesting to observe that mostly past researchers chosen lumped parameter or improved lumped parameter to solve different transient heat transfer problems using either hermite approximation method or polynomial approximation method. And it is seen that no work is done with separation of variables. So it is concluded that from the theoretical investigation of transient heat transfer review based on lumped parameter and improved lumped parameter, in the field of transient heat conduction of multidimensional in cylindrical shape, no work have to done with the help of separation of variables method and polynomial approximation method. So it can be future scope for the new researchers.

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