ABSTRACT

This thesis is aimed at studying the complexities of the fusion process and then implementing the mathematical form of such complexities in a computer program in the form of state space model. The mathematical form of the fusion process is well described through the Magneto-Hydrodynamic Equations (MHDs), which can easily be represented using state space models.

In this thesis the principles governing the transport of particles and energy in high temperature plasma are studied and their state space model has been transformed to workable sizes. In order to make model work in real time through implementation of intelligent techniques, the reduced order model has been made computationally efficient by learning the model behavior through the application of the neural network approach.

The developed intelligent model has been tested for its validity for various inputs and in comparison with the standard full-scale model. The simulated results show that the new Neural Network model reduction methods and their blend with the intelligent modeling approach have worked with high level of accuracy and have opened the way for new research directions.