World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:12, No:02, 2018

Singular Perturbed Vector Field Method Applied to the Problem of Thermal Explosion of Polydisperse Fuel Spray

Authors : Ophir Nave

Abstract : In our research, we present the concept of singularly perturbed vector field (SPVF) method, and its application to thermal explosion of diesel spray combustion. Given a system of governing equations, which consist of hidden Multi-scale variables, the SPVF method transfer and decompose such system to fast and slow singularly perturbed subsystems (SPS). The SPVF method enables us to understand the complex system, and simplify the calculations. Later powerful analytical, numerical and asymptotic methods (e.g method of integral (invariant) manifold (MIM), the homotopy analysis method (HAM) etc.) can be applied to each subsystem. We compare the results obtained by the methods of integral invariant manifold and SPVF apply to spray droplets combustion model. The research deals with the development of an innovative method for extracting fast and slow variables in physical mathematical models. The method that we developed called singular perturbed vector field. This method based on a numerical algorithm applied to global quasi linearization applied to given physical model. The SPVF method applied successfully to combustion processes. Our results were compared to experimentally results. The SPVF is a general numerical and asymptotical method that reveals the hierarchy (multi-scale system) of a given system.

Keywords : polydisperse spray, model reduction, asymptotic analysis, multi-scale systems
Conference Title : ICAM 2018 : International Conference on Applied Mathematics
Conference Location : Bangkok, Thailand
Conference Dates : February 08-09, 2018