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INVESTIGATION OF TURBULENCE WITH REACTING AND MIXING CHEMICAL ELEMENTS OF THE TYPE $A + B \rightarrow$ PRODUCT DESCRIBED BY SPACE-TIME FUNCTIONAL FORMALISM

M. C. MESHRAM[1] AND KIRTI SAHU[2]

[1] Department of Mathematics,
Laxminarayan Institute of Technology,
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur-440033, India
[2]Department of Mathematics,
St. Vincent Pallotti College of Engineering and Technology,
Nagpur-441108, India

Abstract

The governing equations for the description of turbulence with reacting and mixing n-chemical elements described by R. S. Brodkey [1] and E. E. O'Brien [2] are considered. For convenience, we consider a turbulent reaction mixture with two reacting and mixing chemical elements A and B. The reactions are irreversible, isothermic, second order and type of reaction is $A + B \rightarrow$ Product. A brief account of derivation of the equations describing the dynamics of the energy spectrum density functions for the velocity field and the concentration fields A and B derived on using Lewis-Kraichnan [3] space-time version of the Hopf [4] functional formalism and multiple-scale-cumulant-expansion method is given. The equations for spectrum functions of the velocity field and the concentration fields derived on employing multiple-scale-cumulant-expansion method by Joshi N. E. and Meshram M. C. [5] are considered. These equations are first written in dimensionless form and then integrated numerically. The numerical values of the energy of velocity field as well as that of concentration fields are obtained. These values are used to evaluate the statistical quantities describing the turbulence with reacting and mixing chemical elements for large Reynolds number up to 1600. The quantities include enstropy of concentration fields, skewness of concentration fields, dissipation energy of concentration fields, energy transfer functions of concentration fields and Taylor's micro-scales for concentration fields .We present this in the form of graphs for the representative values of Reynolds number $R = 800$ and $R = 1600$ for the turbulence under study. The analysis of the numerical values of statistical quantities thus obtained is carried out and the laws governing these quantities are investigated. Also, we discuss the merits and scope of the present closure scheme for studying similar turbulent flows.