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主燃孔射流对模型燃烧室流动及燃烧影响的数值研究

Numerical study of influences of primary jets on turbulent flows and spray combustion in model combustor

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中文关键词： 双级轴向旋流器 湍流流动 主燃孔射流 燃烧数值模拟 液雾燃烧

英文关键词:dual-stage axial swirler turbulent flow primary jet combustion numerical simulation spray combustion

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作者	单位
徐榕	南京航空航天大学 能源与动力学院 江苏省航空动力系统重点实验室, 南京 210016
赵坚行	南京航空航天大学 能源与动力学院 江苏省航空动力系统重点实验室, 南京 210016
王锁芳	南京航空航天大学 能源与动力学院 江苏省航空动力系统重点实验室, 南京 210016

中文摘要:

数值研究不同主燃孔射流对模型燃烧室内湍流流动与液雾燃烧全流程流场的影响，采用微分方程和分区相结合方法生成包括突扩扩压器、帽罩、双级轴向旋流器、火焰筒及内外环通道的模型燃烧室三维结构化网格；在任意曲线坐标系下采用多区域耦合法计算模型燃烧室的流场.采用RNG（re-normalization group）k-ε湍流模型，旋涡破碎湍流燃烧模型模拟湍流燃烧过程；颗粒轨道模型模拟两相流动.计算结果与试验数据的比较表明：本计算方法与数学模型适用于预测模型燃烧室湍流冷、热态流场；主燃孔结构参数变化对气流温度分布的影响比对回流区尺寸与速度分布的影响更为明显，其中主燃孔Ⅱ的出口温度分布要比其他主燃孔的出口温度分布更为合理.

英文摘要:

The influences of different primary jets on turbulent flows and spray combustion of a dual swirl model combustor were numerically studied. The three-dimensional block-structured grids were generated by the differential equation method and sub-regional method for a model combustor including a dump diffuser, cowl, dual-stage axial swirler, flame tube as well as outer and inner annuluses. In arbitrary curvilinear coordinates, a multi-zone coupling approach was used for model combustor flow field numerical investigation. RNG (re-normalization group) k-ε model and EBU (eddy break-up) turbulent combustion model were employed for turbulent combustion. The particle trajectory model was applied to simulating two-phase flows. Comparisons between predicted and experimental data show that simulation is appropriate for predicting turbulent cold and combustion flow field. The influences of different primary hole structure parameters on gas temperature distributions are more obvious than the size of recirculation zone and profiles of velocity, and profile of exit temperature of the primary hole Ⅱ is more rational than those of other primary holes.

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