ISSN: 2168-9873
Journal of Applied Mechanical Engineering
OPEN ACCESS Freely available online
Perspective

Numerical Simulation of Spray Combustion Considering Soot Formation and Thermal Radiation

Jianmin Wang *

Department of Geography, South Dakota State University, Brookings, South Dakota, USA

DESCRIPTION

Controlled combustion is an intricate phenomenon, as it includes various physical transports and complex chemical reactions together in a coupled manner. Today, there is a global interest towards the clean power generation addressing the concern towards sustainability. Therefore, tremendous efforts have been put by the researchers to improve the combustion system that focus on reducing emissions, increasing combustion efficiency and lowering costs without forfeiting the reliability. Gas turbine is a power generating device which is used in aircraft and marine engines and also in stationary electrical power plants. In the gas turbine combustor, chemical energy of the fuel is converted to heat energy for its subsequent conversion to mechanical work in the turbine. The gas turbine combustors operate at a very high air-fuel ratio in order to keep the turbine inlet gas temperature within the metallurgical limit. Normally the air supplied from the compressor is split and admitted at different points of the combustor as primary, secondary and dilution air. Out of them, the primary air oxidizes the fuel and helps in stabilizing the flame, secondary air completes the combustion of left-over combustible species and the dilution air decreases the gas temperature leaving the turbine by maintaining the right pattern factor.

Either a single or a set of fuel injectors are placed centrally to the combustor to supply the fuel continuously, particularly in case of aviation gas turbines. Stationary gas turbines often use gaseous fuels, like natural gas, for their operation. The development of the aviation gas turbine engines saw a remarkable progress in the last century. Amongst the various components of the engines, combustors have experienced many important modifications. The major criteria, over which the developments in gas turbine combustor take place, are high combustion efficiency, stabilization of flame, ready re-ignition following flame extinction and reduced emission of the pollutants. In addition, significant research work is being carried out on the use of alternative liquid fuels in gas turbines mainly derived fuels like bioethanol and biodiesel and on the material aspects of various parts.

The keen interest on alternate fuels in gas turbine applications for the future, the present day aviation engines almost entirely run on kerosene based jet fuels. The fuel is sprayed in the stream of air using an atomizer and is burned as a non-premixed flame. Considering the present day concern over carbon loading on the environment, a lot of emphasis is being given on reducing the specific fuel consumption of the engines. The big players in the field are competing with one another in developing engines with higher fuel efficiency and therefore lower emission. One important means of achieving this target is to make the engine lighter in weight using suitable materials. Ceramic and composite materials are being developed for various parts. However, one important concern in the development of the materials is the temperature of the gas which they have to withstand.

CONCLUSION

Computational fluid dynamics is being used widely to study the combustion phenomena and the resulting temperature distribution in the gas turbine combustor. Simulation results can reduce the cost of development to a great extent by obviating the challenge of cut and try method. In addition to the complex turbulent, swirling flow and the existence of the two phases. The combustor, formation of soot and energy exchange due to radiation play significant roles in the prediction of gas turbine combustion behavior. Both the gas temperature leaving the combustor and the temperature of the different combustor parts. Get affected by the soot distribution in the flame and the radiative energy exchange. Therefore, numerical studies on spray combustion considering soot formation and radiative energy exchange in a combustor firing kerosene fuel have been taken up as focus of the present research.

Correspondence to: Jianmin Wang, Department of Geography, South Dakota State University, Brookings, South Dakota, USA, E-mail: jianmin@sdstate.edu

Received: 01-Dec-2022, Manuscript No.JAME-22-19527; **Editor assigned:** 05-Dec-2022, Pre QC No. JAME-22-19527 (PQ); **Reviewed:** 19-Dec-2022, QC No JAME-22-19527; **Revised:** 26-Dec-2022, Manuscript No. JAME-22-19527 (R); **Published:** 02-Jan-2023, DOI: 10.35248/2168-9873.22.11.451.

Citation: Wang J (2023) Numerical Simulation of Spray Combustion Considering Soot Formation and Thermal Radiation. J Appl Mech Eng. 11:451.