# COMBUSTION WEBINAR

## Direct moment closure approach for turbulent combustion

**Speaker:** Kun Luo, Zhejiang University, China
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**Biography:** Kun Luo is currently a full professor at the State Key Laboratory of Clean Energy Utilization, Shanghai Institute for Advanced Study, Zhejiang University. He received his PhD from Zhejiang University in 2005 and worked at the Center for Turbulence Research, Stanford University from 2007 to 2009. His research centers on computational multiphase flow and combustion in energy system. He has undertaken over 10 projects as the principal investigator, and authored/co-authored more than 150 international peer-reviewed papers. He has received the National Science Fund for Distinguished Young Scholars, and the Distinguished Paper Award at the 33rd international symposium on combustion.

**Abstract:** A new direct moment closure (DMC) approach has been developed for large eddy simulation of turbulent combustion in recent years. In this approach, the filtered chemical reaction rate is directly closed in the form of Arrhenius law, and the whole temperature exponential function term is treated as a single variable to avoid the traditional Taylor series expansion. As a result, the filtered chemical reaction rate can be readily modeled with the first-order and second-order moments, plus higher-order correlations. The approach has been extensively evaluated and validated on DNS database and laboratory flames with different combustion modes, including premixed, partially premixed and non-premixed flames; different flame configurations, including jet and swirling flames; and different fluid states, including subcritical and supercritical flames. It has been found that the DMC approach is much better than the laminar chemistry closure approach even with the first-order moment model. The performance of the second-order moment model with a four-step simplified chemistry can be comparable to current advanced models with detailed chemistry for the Sydney piloted partially premixed flames with both homogeneous and inhomogeneous fuel/air inlets. The DMC approach is robust and easy to implement, which provides a novel tool for modelling turbulent combustion and deserves further investigations.

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