Linear-Eddy Modeling of NO_x and CO emissions in lean premixed combustion

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Motivation

Modern stationary gas turbines often operate under lean premixed conditions. Lean fuel-air mixtures lead to low combustion temperatures and therefore to potentially low NO_x emissions. However, lean premixed flames are prone to combustion instabilities with local flame quenching leading to high emissions. A comprehensive understanding of the physical mechanisms leading to combustion instabilities is necessary to control and to avoid high emissions under lean premixed conditions.

Aufgabenstellung

The active control of fuel-air mixing is one possibility to avoid combustion instabilities and high emissions under lean premixed combustion. In the project B9 within the Collaborative Research Center (SFB) 557 at the Berlin University of Technology combustion dynamics as well as pollutant emissions in lean premixed combustion systems are experimentally controlled based on the adaptation of the fuel/air mixing profile. In close collaboration with the experimental investigations we will develop numerical modeling strategies to predict and avoid high pollutant emissions through active control of the fuel-air mixing profile.

Lösungsansatz

The steady and unsteady flow fields within the combustor will be modeled with 2D/3D CFD calculations using Reynolds-stress modeling for the turbulent flow field and a TFC model for the combustion. In addition we will apply the 1D Linear-Eddy mixing model (LEM) for detailed investigations of pollutant emissions under lean premixed conditions with varying fuel-air mixtures.

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