

**OPTICAL DETERMINATION OF TEMPERATURE AND
CONCENTRATIONS FOR LAMINAR AND TURBULENT GAS MIXTURES**

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ABSTRACT. In this study, we present inverse radiation calculation models to reconstruct temperature and species concentrations for laminar gas mixtures and time-averaged temperature, species concentrations and their root mean square (rms) values for turbulent mixtures, based on line-of-sight spectral transmissivity measurements. For turbulent gas mixtures, time-averaged transmissivities and their rms values are successfully related to time-averaged temperatures, species concentrations and their rms values by considering interactions between turbulence and radiation (TRI). The turbulence length scale is retrieved simultaneously with the turbulent scalars. Optimal wavenumber ranges for retrieving temperature and species concentrations of the gas mixtures are discussed. To validate the models, measured spectra are synthesized through calculations from HITEMP 2010 for laminar and turbulent gas mixtures of CO₂, H₂O and CO with N₂.