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Dynamic behavior of lean swirling premixed flame generated by change in gravitational orientation -Nonlinear forecasting based on the complex network theory MASAHITO AMANO, KOSHIRO MAKI, TAKAYA MIYANO, HIROSHI GOTODA, Ritsumeikan University — We experimentally investigated the deterministic nature in the dynamic behavior of a lean swirling premixed flame generated by a change in gravitational orientation from the viewpoint of nonlinear forecasting based on the complex network theory. When the gravitational direction is changed relative to the flame front, i.e., in inverted gravity, an unstable flame is formed in a limited domain of equivalence ratio and swirl number (Gotoda. H et al., PRE, vol. 81, 026211, 2010). A radial basis function network, which quantifies the predictability of time variations in flame front fluctuations of the unstable flames, is applied as a sophisticated nonlinear forecasting method in this work. A nonlinear forecasting approach based on the complex network theory clearly demonstrates that the dynamic behavior of flame front fluctuations represents low-dimensional deterministic chaos. The deterministic nature in the dynamic behavior of flame front fluctuations revealed using the radial basis function network has not yet been reported in previous research on the flame front instability.

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