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Nonlinear dynamics of flame front instability induced by radiative heat loss: period-doubling bifurcation and chaos HIKARU KINUGAWA, KAZUHIRO UEDA, Department of Mechanical Engineering, Ritsumeikan University, 1-1-1 Nojihigashi, Kusatsu, Shiga 525-8577, Japan, HIROSHI GOTODA, Department of Mechanical Engineering, Tokyo University of Science, 6-3-1 Niijuku, Katsushika-ku, Tokyo 125-8585, Japan — We numerically study the nonlinear dynamics of flame front instability induced by radiative heat loss on the basis of dynamical systems theory. Our previous studies have shown that the radiative heat loss significantly produces the deterministic chaos of flame front temperature fluctuations throughout the period-doubling bifurcation known as Feigenbaum scenario [Gotoda et al., Combust. Theor. Model. 14, 479-493 (2010)], while its short-term behavior can be predicted using a local and global nonlinear predictors [Gotoda et al., Chaos 22, 033106 (2012)]. The present study reports that the similar kind of bifurcation process clearly appears at the fuel concentration, and that the fuel concentration dynamics in the well-developed chaos region is much more complicated than that of the flame front temperature. Recurrence quatification analysis we adopted in the present study can quantify the significant changes in the dynamics in the chaos region that cannot be capture in the bifurcation diagram.

Hiroshi Gotoda
Department of Mechanical Engineering, Tokyo University of Science,
6-3-1 Niijuku, Katsushika-ku, Tokyo 125-8585, Japan

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