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Effects of Frequency spacing on Limit-cycle Mode Suppression of Coupled Unstable Thermoacoustic Modes VISHAL ACHARYA, TIMOTHY LIEUWEN, Georgia Inst of Tech — Combustion instabilities are typically characterized by a single dominant peak at the unstable frequency of the limit-cycle. However, this does not imply the presence of only one unstable mode in the system. Often, multiple linearly unstable modes in the system interact and couple through nonlinearities in the unsteady heat release rate oscillations. This coupling is controlled by several parameters such as: the mode shapes, temporal growth rates, modal frequencies and the frequency spacing. For the coupling between two unstable modes, when the frequencies are far apart (of the order of the frequencies themselves), the modal interactions can result in the suppression of one mode by the other under certain conditions eventually leading to the limit-cycle amplitude of the unsuppressed mode. However, in the case of frequency spacing that is small (of the order of the growth rate of the modes), the final limit-cycle amplitude for the unsuppressed mode is the same as before but for different conditions that are controlled by the new frequency spacing parameter. This implies that while the final limit-cycle amplitude for the two cases might be independent of frequency spacing, the limit-cycle stability in the case of closely-spaced modes is a strong function of the frequency spacing.

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