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Dissonant Modes of Bottle-shaped Thermoacoustic Prime Movers Part 2: Hysteresis of Mode Transitions DAVID PEASE, BONNIE ANDERSEN, Utah Valley University — Transition regions to higher resonant modes of a bottle-shaped thermoacoustic prime mover (neck: 5.39 cm long, 1.91 cm ID; variable cavity with a sliding piston: up to 38 cm long, 4.76 ID) were studied. As the piston is extended, lengthening the cavity, starting from the neck, a transition of the dominant frequency from the fundamental to the first overtone occurs. However, when the length is then shortened, transition back to the first mode does occur at the same piston position, revealing hysteresis. Within the window of hysteresis for the cavity length, either state of the fundamental or first overtone is possible. Transition regions to higher modes continue as the length of the cavity is increased. The position and width of the hysteresis was studied for the first two transition regions as a function of input power and stack volume filling factor. Input powers studied were between 12.0 and 16.5 W and volume filling factors for the stack were about 3.0, 3.7 and 4.9%. The transition regions occurred with cavity lengths between 12.6 and 14.0 cm for the first transition and between 25.0 and 27.8 cm for the second transition. Preliminary results indicate that the transition region occurs shallower in the cavity and the hysteresis widens as the input power is increased. The hysteresis is wider for the second transition region. Decreasing the stack mass causes an increase of the hysteresis width, but has no strong effect on the hysteresis depth.

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