Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Instability of propagating axial symmetric waves generated by a vertically oscillating sphere MENG SHEN, YUMING LIU, Mechanical Engineering Department, Massachusetts Institute of Technology — We study the instability of propagating axial symmetric waves in a basin that are generated by a vertically oscillating sphere. Laboratory experiments indicate that when the oscillation amplitude exceeds a threshold value, the axial symmetric propagating waves abruptly transfigure into non-axial symmetric waves. Fully-nonlinear time-domain numerical simulation of wave-body interaction is applied to describe the nonlinear temporal and spatial evolution dynamics of the propagating waves. Transition matrix method is employed to analyze the stability of the nonlinear time periodic wave-body interaction system. We identify the fundamental mechanism leading to the instability of the wave-body system and investigate the critical condition for the occurrence of the instability. We quantify the growth rate and dominant modes of unstable disturbances and study their dependence on physical parameters including body motion frequency and amplitude, body geometry, surface tension and basin size. Moreover, the long-time evolution dynamics of the unstable wave-bod y system including wave patterns and responsive body forces are also investigated.

Meng Shen
Mechanical Engineering Department, Massachusetts Institute of Technology

Date submitted: 30 Jul 2015 Electronic form version 1.4