Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Small Scale Effect on Flow-Induced Instability of Double-Walled Carbon Nanotubes TAI-PING CHANG, National Kaohsiung First University of Science & Technology, MEI-FENG LIU, I-Shou University — Small scale effect on flow-induced instability of double-walled carbon nanotubes (DWCNTs) is investigated using an elastic shell model based on Donnell's shell theory. The dynamic governing equations of DWCNTs are derived on the basis of nonlocal elasticity theory, in addition, the van der Waals (vdW) interaction between the inner and outer walls is considered in the shell modeling. The instability of DWCNTs that is induced by a pressure-driven steady flow is studied. The numerical computations indicate that as the flow velocity increases, DWNCTs have a way to get through multi-bifurcations of the first and second bifurcations in turn. It can be concluded that the critical flow velocity is closely correlated to the ratio of the length to the radius of DWCNTs, the pressure of the fluid and the small scale effects. Furthermore, it is interesting to notice that as the small scale effects are considered, the first critical flow velocities of DWCNTs decrease as compared to the results with the classical (local) continuum mechanics, therefore, the small scale effects play an important role on performing the instability analysis in the fluid-conveying DWCNTs.

Tai-Ping Chang
National Kaohsiung First University of Science & Technology

Date submitted: 06 Jun 2011 Electronic form version 1.4