1171-35-57 **Vera Mikyoung Hur** and **Zhao Yang*** (zhaouiuc@illinois.edu). *Unstable Stokes waves, capillary-gravity waves, and Wilton ripples.*

A Stokes wave, namely a $2\pi/\kappa$-periodic nonlinear surface wave on an incompressible inviscid fluid of unit depth, is known to be subject to the Benjamin-Feir modulational instability when $1.3627\ldots < \kappa$. The Benjamin-Feir instability was proved by Bridges and Mielke in 1995. Besides the instability of Benjamin-Feir's, numerical investigations suggested that the Stokes wave may be subject to some additional instabilities. In particular, recent work of Deconinck and Oliveras found bubbles of unstable spectra near the imaginary axis which they referred to as "high-frequency instabilities". However, there was no rigorous treatment for the additional instabilities. We developed a periodic Evans function approach to study the stability of Stokes wave of small amplitude. By analyzing the periodic Evans function near the origin, we recovered the well-known Benjamin-Feir instability, giving an alternative proof. By studying the function at the "resonance high-frequency of order 2", we proved a Stokes wave is unstable away from the origin, provided that $0.86430 < \kappa < 1.00804$, justifying the additional instabilities. The approach also applies to stability study of capillary-gravity waves and Wilton ripples. (Received August 06, 2021)