

Liu Bie Ju Centre for Mathematical Sciences
City University of Hong Kong

Mathematical Analysis and its Applications Colloquium

Organized by Prof. Ya Yan Lu and Prof. Roderick S. C. Wong

Surface instability, bifurcation and variational principle

By

Professor Yichao Chen
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University of Houston, USA

Date : 4 May, 2017 (Thursday)
Time : 4:30 pm to 5:30 pm
Venue : **Room Y5-205**
Yellow Zone, Level 5, Academic 1 (AC1)
City University of Hong Kong

ABSTRACT:

The study of surface instability of elastic half-spaces appears was initiated by M. A. Biot, who found that an elastic half-space becomes unstable and exhibits a surface waviness at a critical value of 0.456 compressive strain. This critical value corresponds to a possible bifurcation point. According to the adjacent equilibrium stability criterion, a primary equilibrium state becomes unstable when there are other equilibrium states in a neighborhood. This stability criterion, however, cannot explain why the primary equilibrium state is stable before reaching the bifurcation point, and why it is unstable after passing the bifurcation point.

In this talk, we present a stability analysis based on the energy stability criterion, which asserts that an equilibrium state is stable if an appropriate potential energy functional assumes, at the equilibrium state, a minimum in a class of kinematically admissible states. To overcome the difficulty that the energy associated with a deformed half-space is infinite, we treat the half-space as the limit of a sequence of bounded sub-domains. The second variation condition is converted to an eigenvalue problem for a system of partial differential equations, with the eigenvalue corresponding to the minimum value of the second variation of the energy functional. This system of partial differential equations is solved by the Fourier transform. It is found that the minimum eigenvalue is positive if and only if the compressive strain of the half-space is less than the critical value 0.456. This provides an effective justification that the half-space is indeed stable before the bifurcation point, and becomes unstable after the bifurcation point.

Light refreshments will be provided before the colloquium from 4:00 pm to 4:30 pm. Please come and join us!

**** All interested are welcome ****

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