

MECHANICS OF LOOPS AND ARCHES

Lawrie Virgin

Department of Civil and Environmental Engineering
Duke University, Durham, U.S.A.

This talk will focus on the deflection and dynamic behavior of very slender structures. For such systems gravity provides a natural loading device, and buckling is a typically encountered feature. Three distinct systems will be considered. First, a *looping arch* constructed from a material with a softening spring characteristic is examined. The phenomenon of interest is the sub-critical pitchfork bifurcation. An approximate energy analysis is followed by a more detailed approach. Second, a *pinched loop* is described in which the ends of a clamped-clamped beam are brought together, and orientation of the loop is shown to have a strong effect on subsequent behavior. Finally, a *deep arch* is subject to end rotation such that snap-through buckling occurs. All of these systems are described analytically in terms of the elastica, and experimental verification is conducted.