Civil Engineering for Sustainability and Resilience International Conference, **CESARE '14**
Amman, Jordan, 24-27 April 2014

BUCKLING AND POST-BUCKLING BEHAVIOR OF BEAMS ON ELASTIC FOUNDATION MODELING BURIED PIPELINES

Charis J. Gantes[1] and Vasileios E. Melissianos[2]

[1]School of Civil Engineering, National Technical University, 9 Herron Polytechniou Street, GR-15780, Zografou Campus, Athens, Greece
email: chgantes@central.ntua.gr; web page: http://users.ntua.gr/chgantes

[2]School of Civil Engineering, National Technical University, 9 Herron Polytechniou Street, GR-15780, Zografou Campus, Athens, Greece email: melissianosv@gmail.com

Keywords: steel thin, cylinder, numerical analyses, analytical calculations

ABSTRACT

Buried pipelines transporting oil products are structures of great financial, environmental and social importance. Such structures must adapt to eventual deformations of the surrounding soil, thus they may be severely damaged by large imposed permanent ground displacements triggered by landslides of seismic fault activation, causing combined axial and bending actions along the pipeline. Prevailing failure modes are tensile fracture at the welds between adjacent pipeline parts and local shell wall buckling in regions of high compressive stresses. The second issue is investigated here, numerically and analytically. The mathematical model used is that of a thin-walled cylindrical steel shell embedded in a uniform, infinitely elastic, continuous medium.

Available analytical expressions for the buckling of bare cylinders under pure compression or bending are extended and simplifying expressions are proposed for cylinders embedded in a surrounding medium and subjected to combined loading. Numerical results from linearized buckling as well as nonlinear finite element analysis, modeling the pipeline and surrounding soil with shell and solid elements, respectively, and accounting for loss of contact between pipeline and soil, are used for comparison and calibration.