Lecture 15 – Mechanical Design: Lateral Bucking

Lecture Goals

- Students will be able to:
  - characterize lateral buckling mechanisms,
  - identify engineering tools for analysis of lateral buckling, and
  - identify mitigation techniques for lateral buckling.

Reading List

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Lateral Buckling

- Alternative Design
  - HP/HT lines
  - Technical or economic constraints for upheaval buckling mitigation schemes
- Similarities with Upheaval Buckling Analysis
  - Pressure, thermal expansion and axial loads
  - Continuous or discontinuous lateral frictional support
  - Effective axial force and stability
- Key Issues
  - Uncertainty on lateral buckling
  - Reliability methods
  - Low-cycle fatigue

Lateral Buckle Initiation Strategy

- Criteria
  - Multiple buckle locations
  - Feed-in reduces axial load
  - Increases curvature and local moment
  - Avoid or limit buckle interaction
- Initiators
  - Seabed profile and freespan
  - Wave and current loads
  - Horizontal slack loop (buoyancy)
  - Sleeper
  - Snake-lay installation
- Arrestors
  - Structural anchor
  - Paint source rock dump
  - Expansion loop or sliding PLET

Lateral Buckling Cyclic Operations

- Graphs and diagrams illustrating buckling behavior and cyclic operations
Axial Walking or Ratcheting

- Thermal Gradient
- Cyclic operations
  - Cool down and start-up
- Thermal expansion acts as non-uniform distributed load
- Where is the critical section?

References