STEPHEN SURYASENTANA

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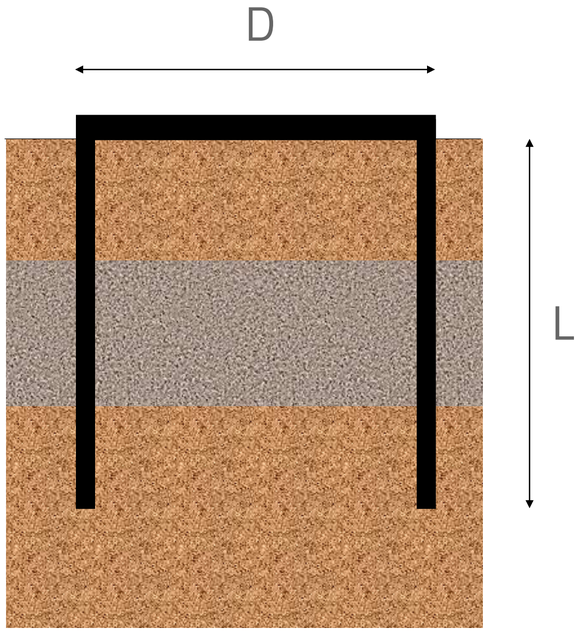
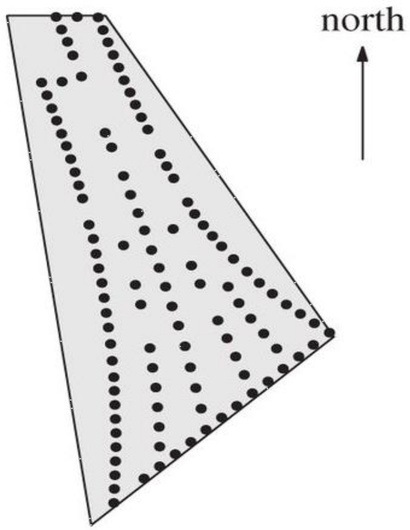
# Simplified model for the stiffness of suction caisson foundations under 6 DOF loading

# background

**Getting larger**

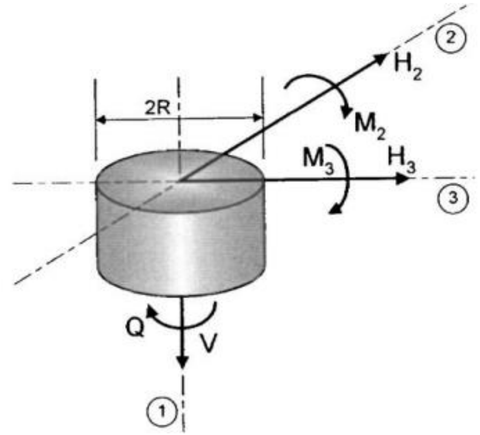



**Need for speed**




Source: Kallehave et al. (2015)

**6 DOF**




Source: Doherty et al. (2005)

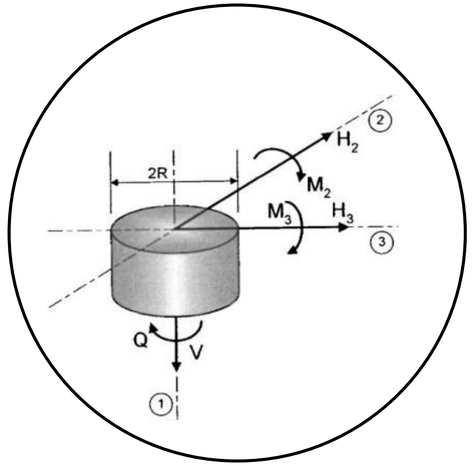
1 **Accuracy**

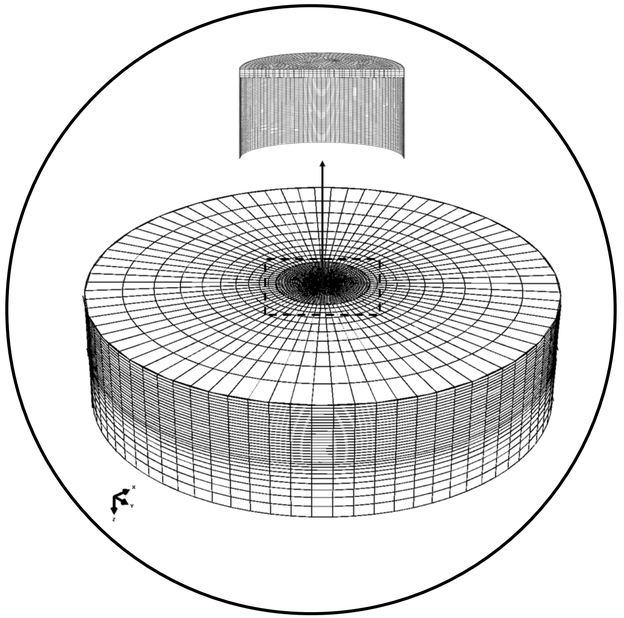
2 **Efficiency**

3 **Completeness**

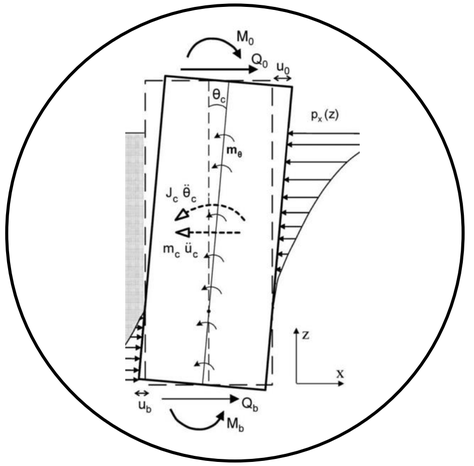
# existing methods

Source: Doherty et al. (2005)



Source: Gerolymos et al. (2006)




## MACRO ELEMENT MODEL

- ✗ Does not work for multi-layered
- ✓ Fast
- ✓ Complete (6 DOF)

## 3DFE MODEL

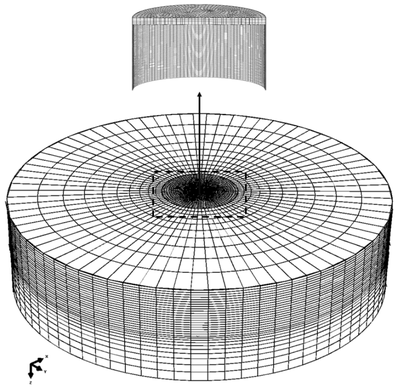
- ✓ Works for multi-layered
- ✗ Slow
- ✓ Complete (6 DOF)

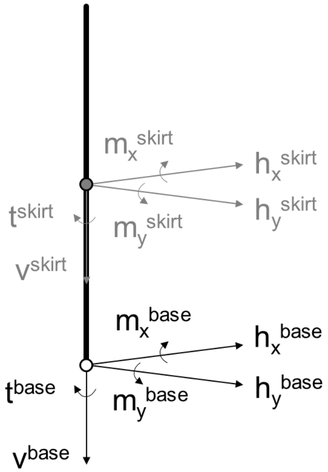
## WINKLER MODEL

- ✓ Works for multi-layered
- ✓ Fast
- ✗ Incomplete (< 6 DOF)

⚠ **Existing design methods do not meet design requirements**

# new method






1 — 2 — 3

## 3DFE MODEL

- ✓ Accurate
- ✗ Slow

## CALIBRATION

Calibrate using local soil stress

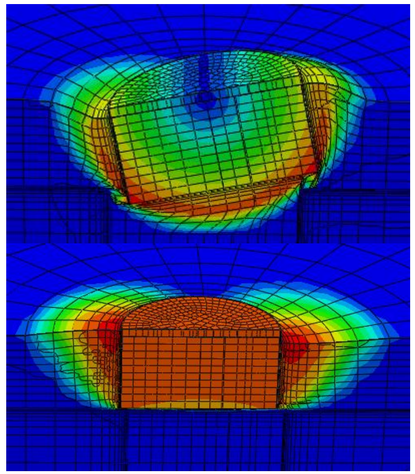
Validate using global stiffness

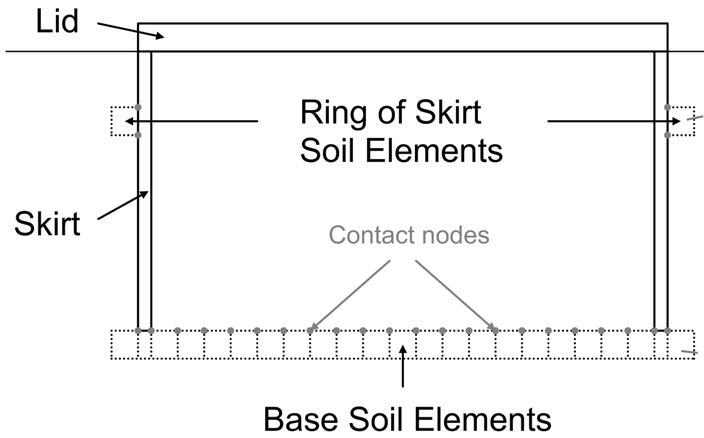
## 1D WINKLER MODEL

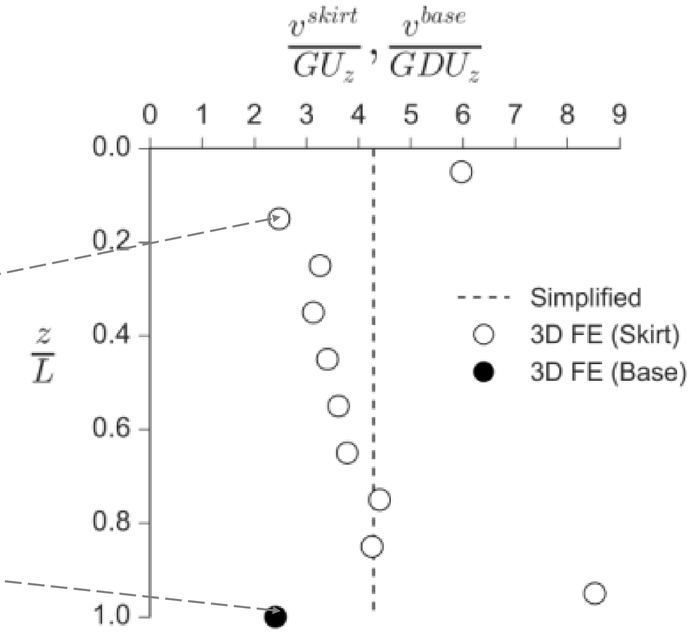
- ✓ Accurate
- ✓ Fast

WAV → **Data compression** → MP3

# results






1 2 3

## 3DFE ANALYSES

4 Displacements (Axial, Lateral, Rotational, Torsional)

## EXTRACTION

Nodal forces to 1D soil reactions

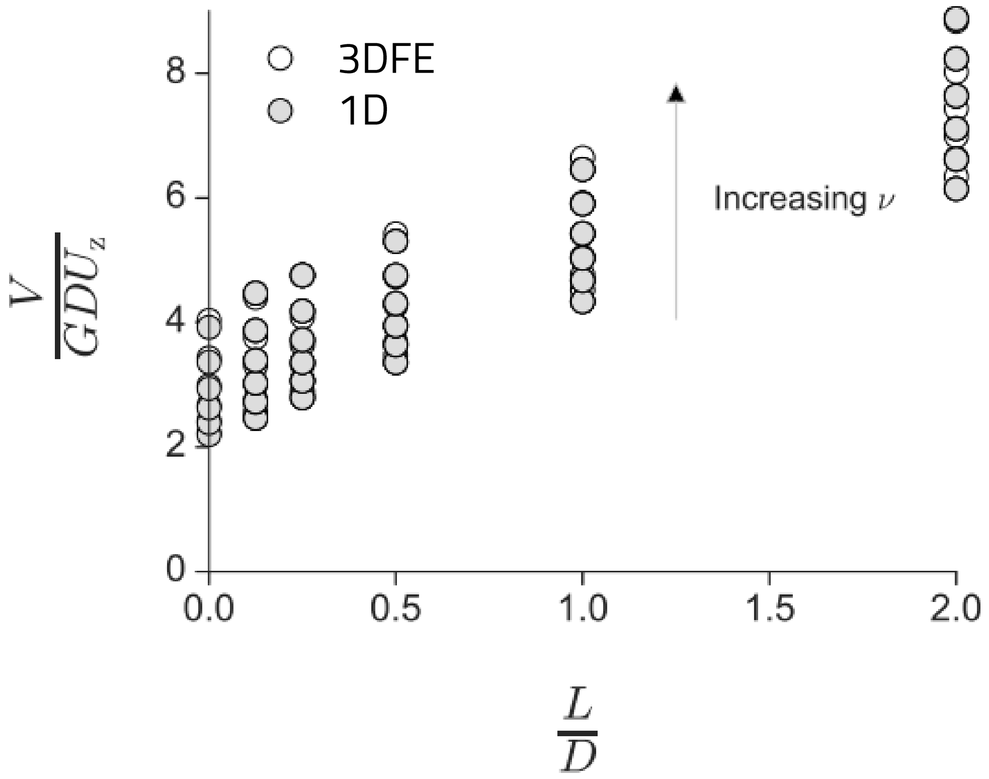
Skirt (distributed) & base reactions

## FORMULATION

Simplify 1D soil reactions

Formulate relationships between 1D soil reactions and local dof

# implications




**Accurate**

‘3DFE-equivalent’ predictions

Minimal loss of precision after calibration

**Fast**

Instantaneous predictions

Ideal for time-consuming applications

e.g. wind farm foundation optimisation

**Complete**

Stiffness predictions for fully three-dimensional loading