



ITASCA™

# Numerical Modelling with FLAC3D

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2019-01-09 – 2019-01-10

# Instructors

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Jessa Vatcher



Mikael Svartsjaern

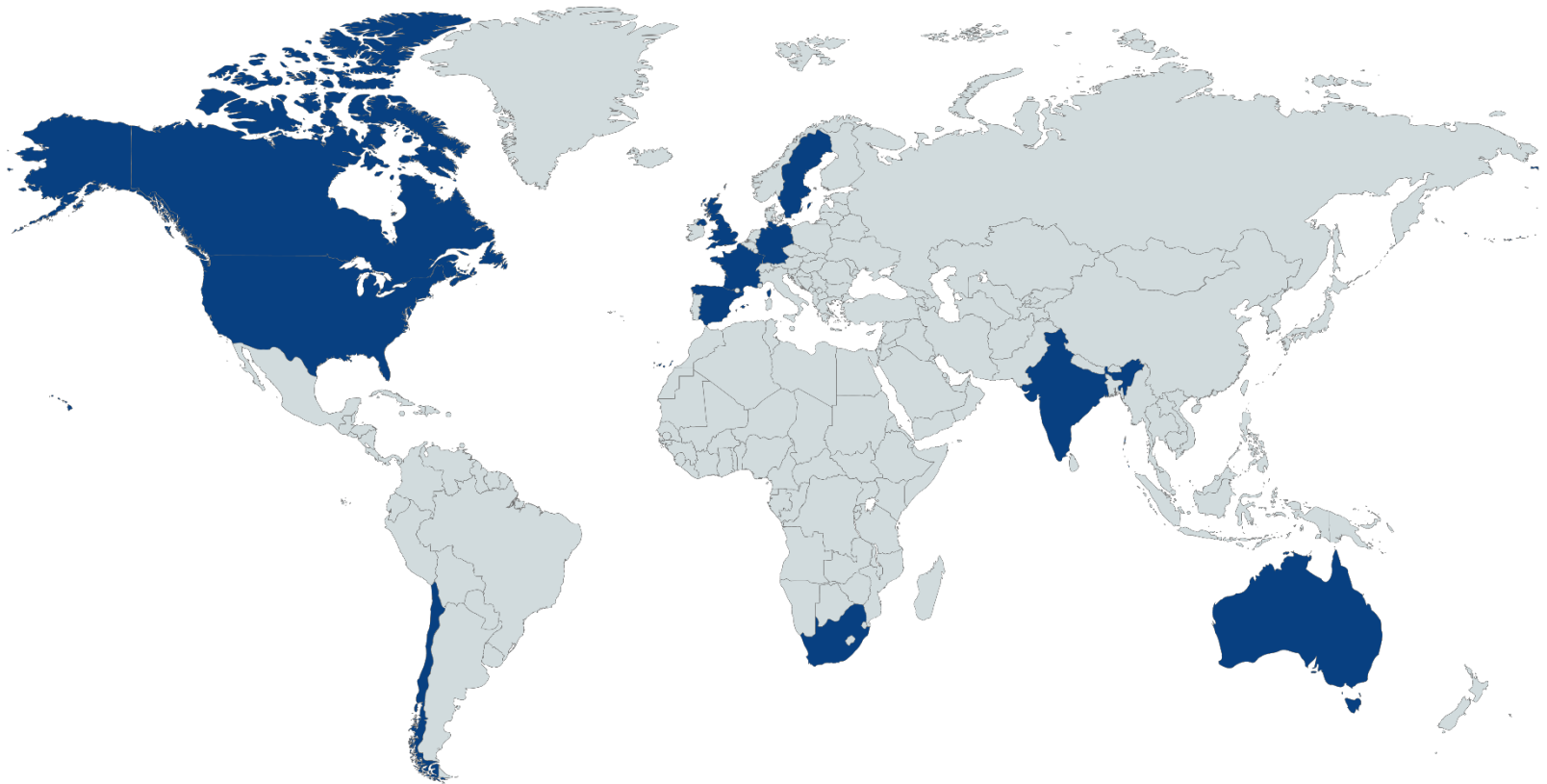


# Schedule

	Day 1: Tunnelling	Day 2: Mining
Morning 1 (2 hr)	<p>Introduction to numerical modelling (why and how)</p> <p>Theoretical background FLAC3D</p> <p>Continuum vs discontinue</p> <p>Finite difference</p> <p>Starting with FLAC3D</p>	<p>Application of modelling workflow:</p> <ol style="list-style-type: none"> <li>1. Mesh generation</li> <li>2. Interfaces</li> <li>3. Boundary conditions</li> <li>4. Constitutive model and properties</li> </ol> <p>Theoretical Background FLAC3D</p> <p>Plasticity</p>
Morning 2	<p>Application of modelling workflow:</p> <ol style="list-style-type: none"> <li>1. Mesh generation</li> <li>2. Boundary conditions</li> <li>3. Constitutive model and properties</li> <li>4. Initial loading</li> </ol>	<p>Application of modelling workflow:</p> <ol style="list-style-type: none"> <li>4. Initial loading</li> <li>5. History points</li> <li>6. Running</li> </ol> <p>Theoretical background FLAC3D</p> <p>Explicit solution scheme</p>
Afternoon 1	<p>Application of modelling workflow:</p> <ol style="list-style-type: none"> <li>5. History points</li> <li>6. Running</li> </ol> <p>Theoretical background FLAC3D</p> <p>Support elements</p>	<p>Theoretical background FLAC3D</p> <p>FISH and Python</p> <p>Application of modelling workflow:</p> <ol style="list-style-type: none"> <li>5. Analysis and plotting</li> </ol>
Afternoon 2	<ol style="list-style-type: none"> <li>7. Analysis and plotting</li> </ol>	<p>Summary, discussion and questions</p>

# Itasca International Inc.

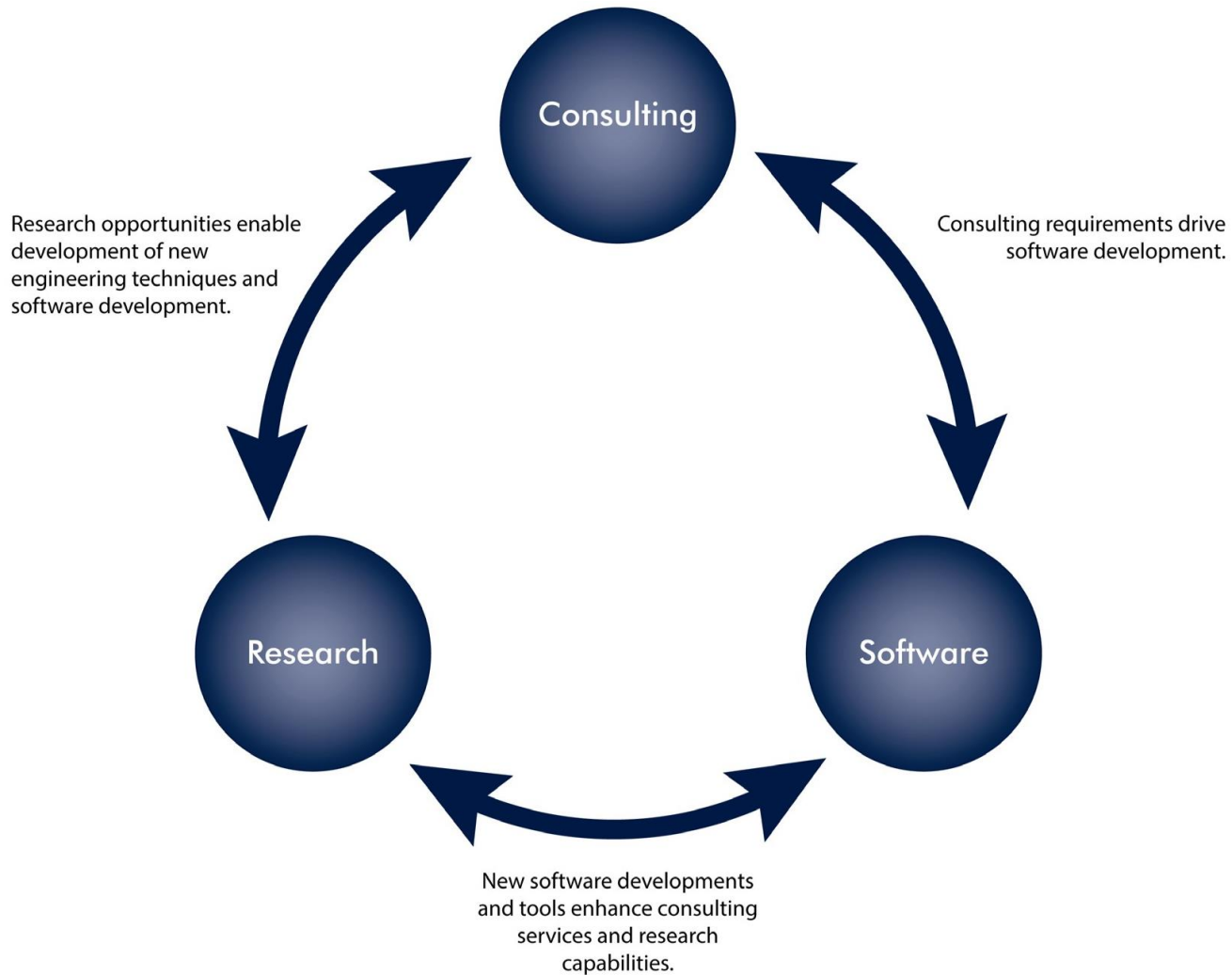
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12 countries, approximately 170 employees

# Itasca International Inc.

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# Itasca Sweden



- Consulting, research & software sales
- 10 employees
- Focus on civil, mining, and spent fuel repositories
  - 3D model creation
  - Numerical modelling and analysis
  - Empirical design, feasibility studies
  - Site investigation

# Itasca's software



**FLAC**®

Explicit Continuum Modeling of  
Non-linear Material Behavior in 2D



**UDEC**™

Distinct-Element Modeling of  
Jointed and Blocky Material in 2D



**FLAC3D**™

Explicit Continuum Modeling of  
Non-linear Material Behavior in 3D



**3DEC**™

Distinct-Element Modeling of  
Jointed and Blocky Material in 3D



**MINEDW**™

Groundwater Flow Code for Mining  
Applications in 3D



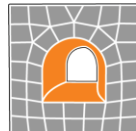
**PFC**™

General Purpose Distinct-Element  
Modeling Framework



**INSITE**™

Integrated Acquisition Processing,  
Management and Visualisation of  
Seismic and Acoustic Monitoring



**Griddle**™

Advanced Grid Generation Software  
for Engineers



**KATS**

Kinematic Analysis Tool for Slopes  
Probabilistic and Deterministic Slope Analysis

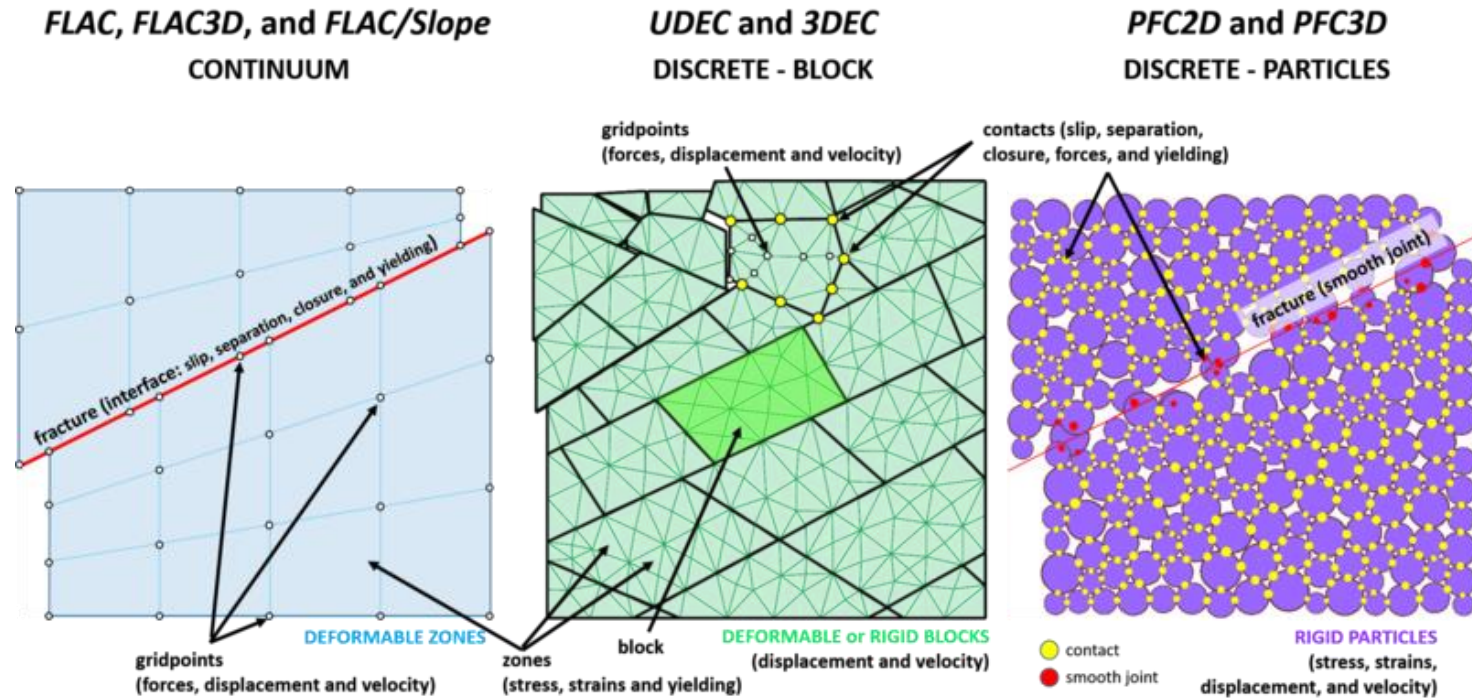
## Geomechanical Software

Common Features:

- Large deformation
- Tracks sequential material failure
- Library of material behavior models
- Incorporates realistic geological features
- Dynamic capabilities
- Groundwater modeling
- Built-in scripting languages



# Software Comparison



<http://www.itascacg.com/software-comparison>

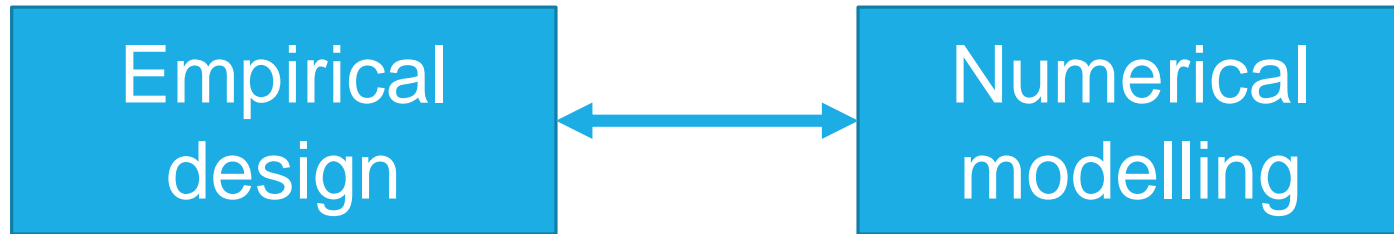


# Let's install the program!

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# Why do we use numerical modelling?

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Approximation is ok  
Simple problems  
Well-studied problems

Accuracy is important  
Interested in probabilistic approach  
Complex problems  
New problems

# Problem solving with numerical modelling

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1. Define the problems and objectives
2. Create a conceptual model of the physical system, focus on simplifications
3. Construct and run model(s)
4. Interpret results

# Problem solving with numerical modelling

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1. Define the problems and objectives

Why am I building this model?

2. Create a conceptual model of the physical system, focus on simplifications

What behaviour do I expect from the rock mass?

3. Construct and run model(s)

What should I be analyzing?

4. Interpret results

# Problem solving with numerical modelling

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1. Define the problems and objectives
2. Create a conceptual model of the physical system, focus on simplifications
3. Construct and run model(s)
4. Interpret results

Focus on simplifications

How can I build a model to test this behaviour?

# Problem solving with numerical modelling

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|--|---|--|
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# Problem solving with numerical modelling

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