Arbeitsbereich Wasserbau
Universität Innsbruck
Techhnikerstraße 13
6020 Innsbruck
www.uibk.ac.at/wasserbau

A Software Tool to evaluate the Internal Stability of Grain Structures

Thomas Etzer
Markus Aufleger
Peter Muckenthaler

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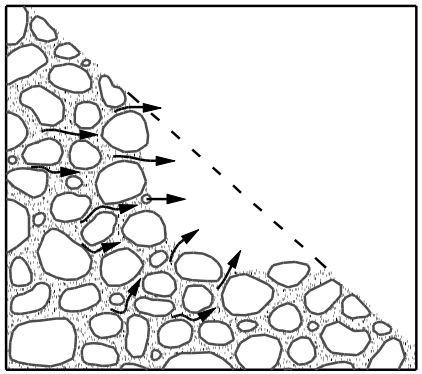
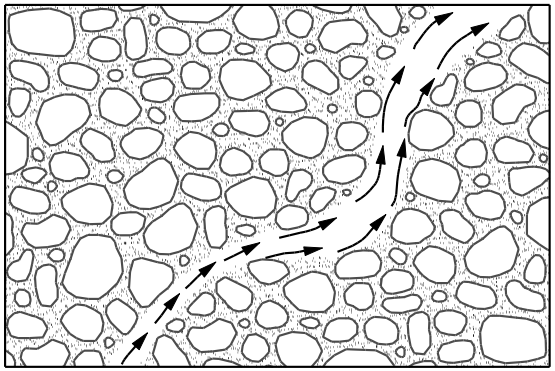
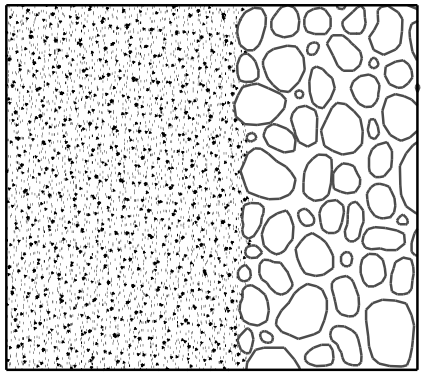
- Introduction
- Motivation
- Prolix-Software
- Conclusions & Outlook

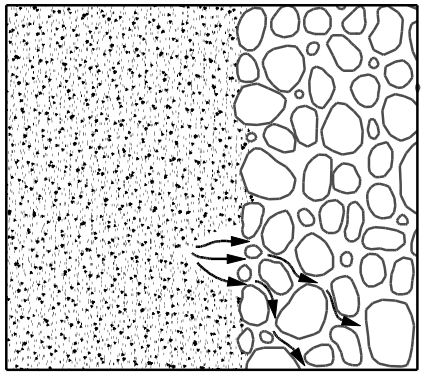
Introduction

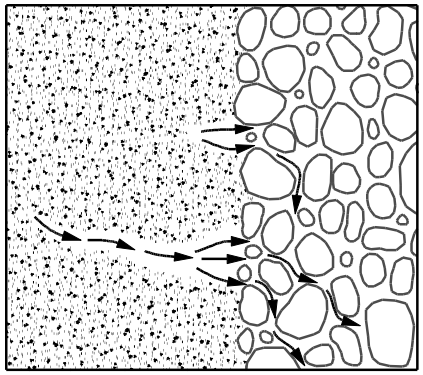
- Various types and notations







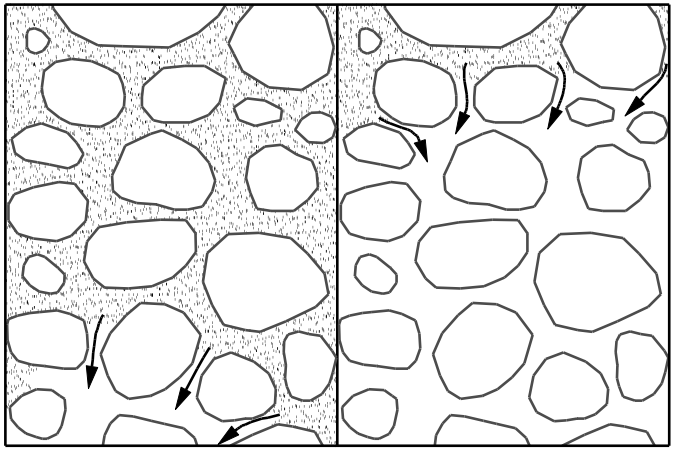


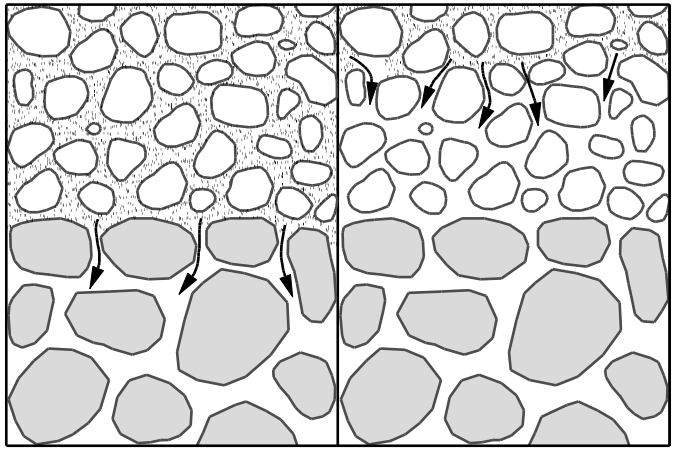


Introduction

Common:

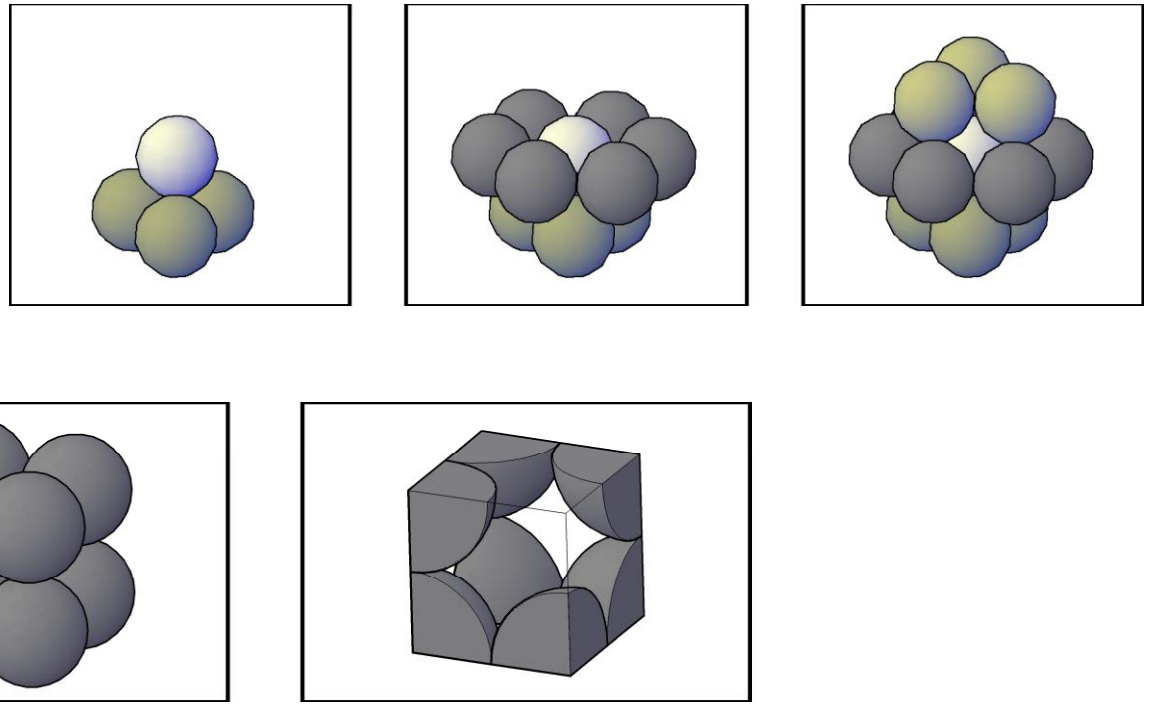
- Stable supporting grain structure
- Small particles moving





Introduction

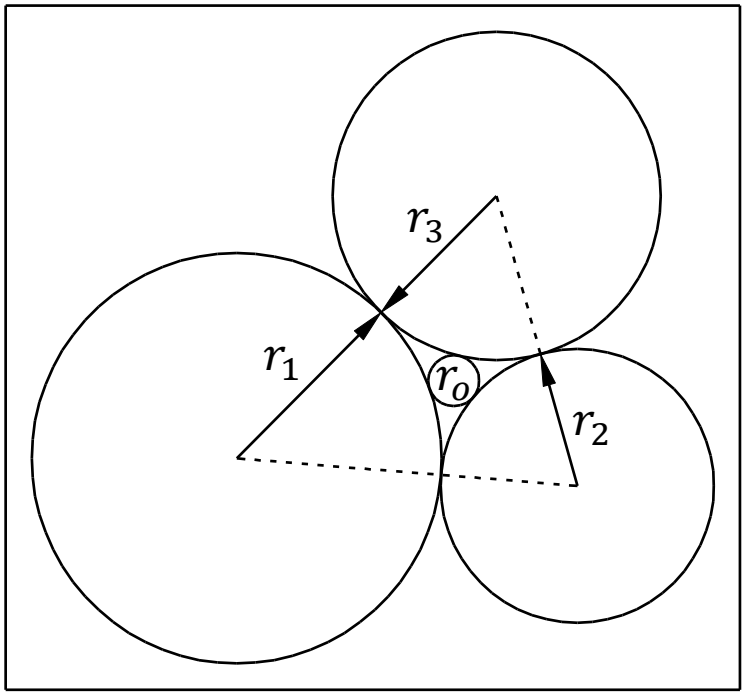
- Treading grains as spheres



Motivation

- SILVEIRA 1965:

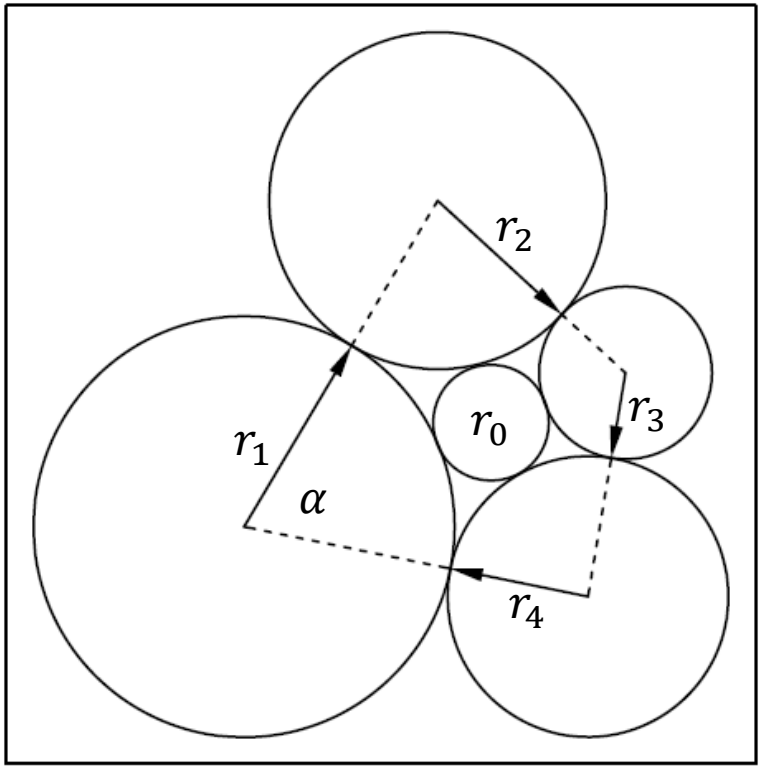
  Diameter of void
  in dense packing



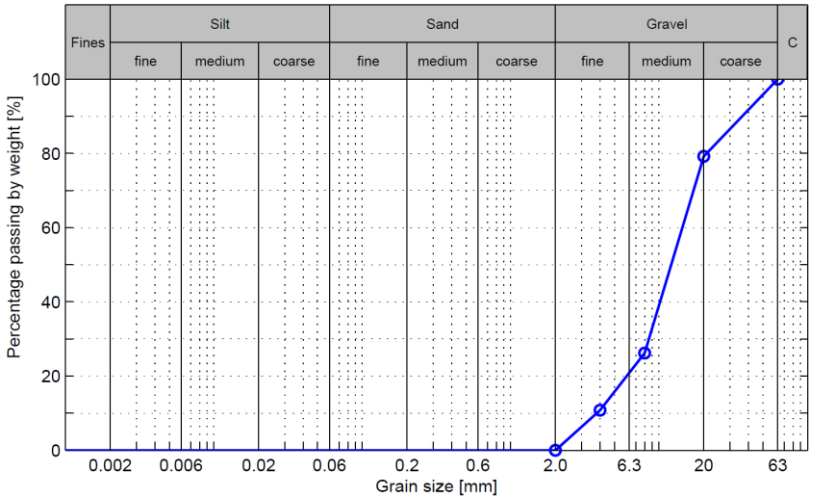
Motivation

- MUCKENTHALER 1989:

  Model for loose packing



Motivation



Particle Size Distribution

⇩

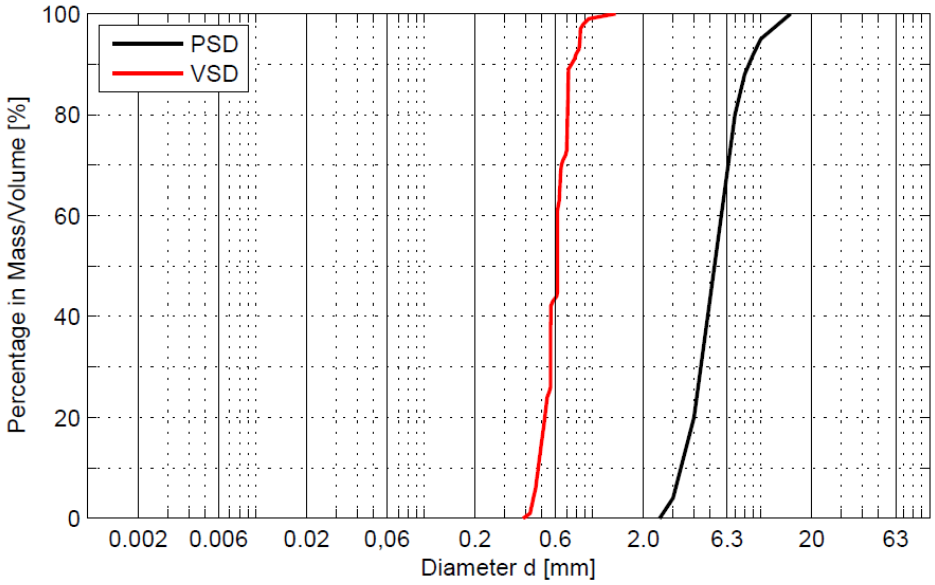
Calculate Number of Grains

⇩

Calculate Probability for each void size

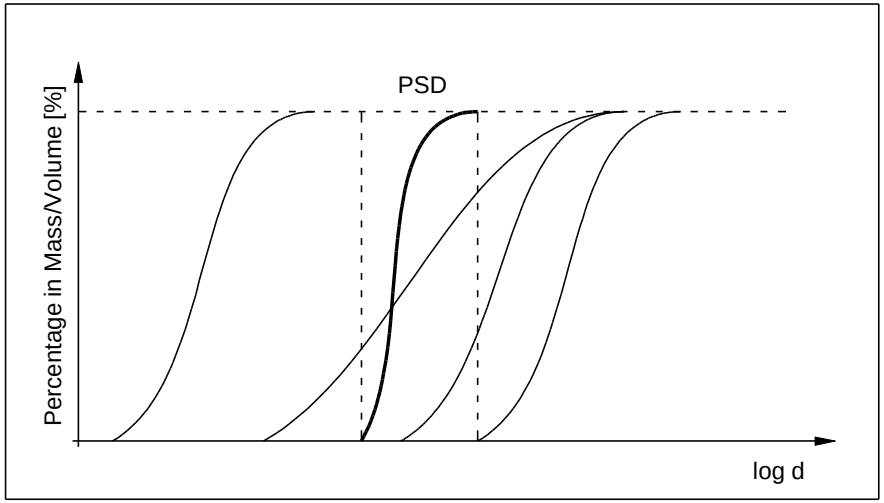
Motivation

- Void Size Distribution



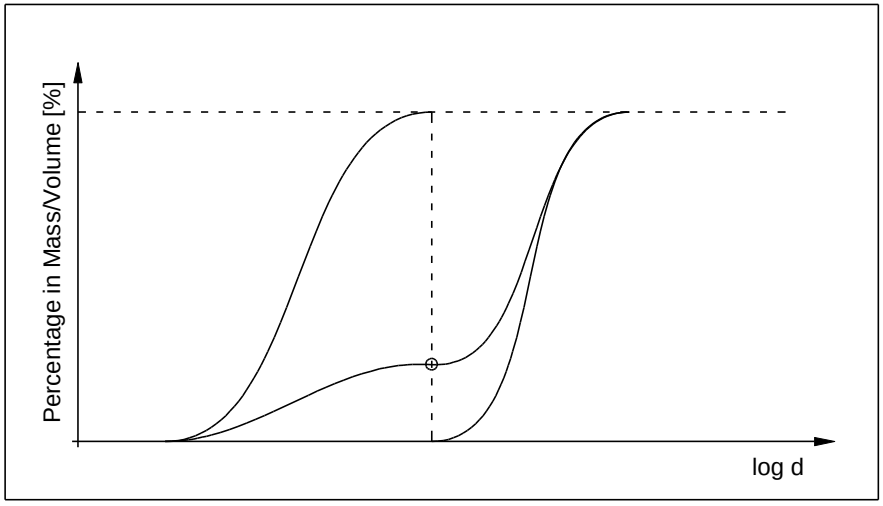
Objective: Geometrical criterion to determine biggest erodible grain.

Motivation

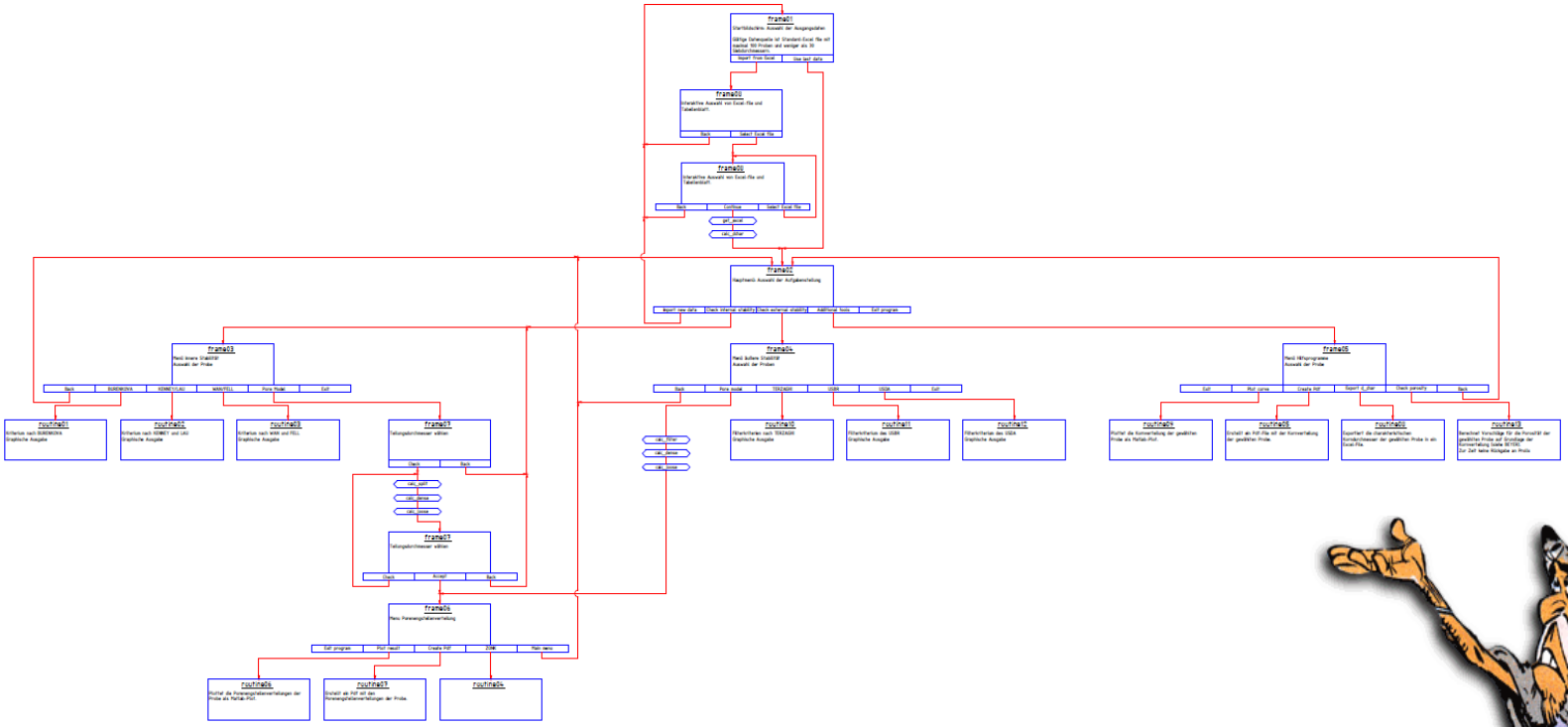


„External Stabilty“
(Filter Problems)

„Internal stability“

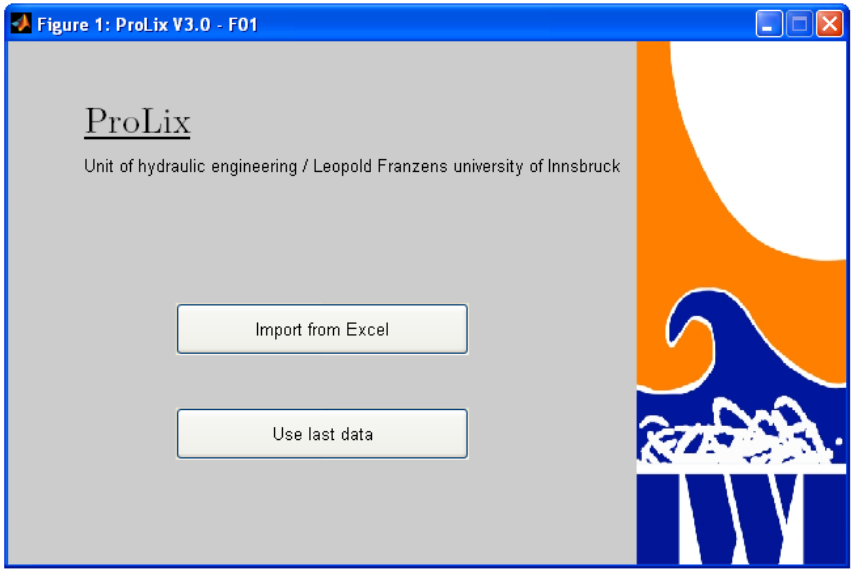


Prolix



Software tool to handle all calculations

Prolix

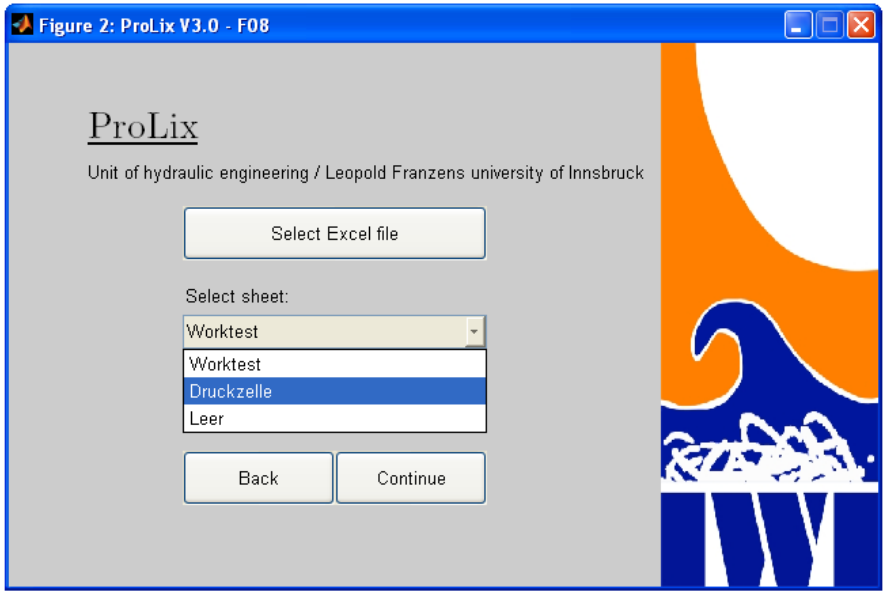


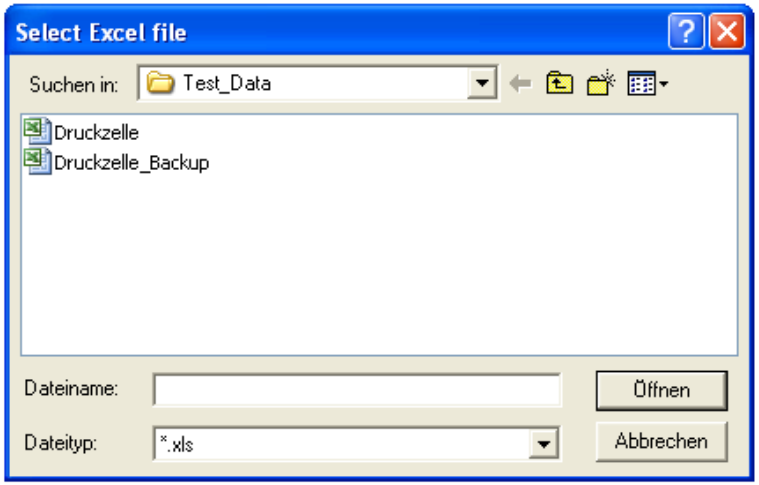
- Matlab-Script files
- Graphical User interface
- Modular => expendable

Prolix

Data-Import:

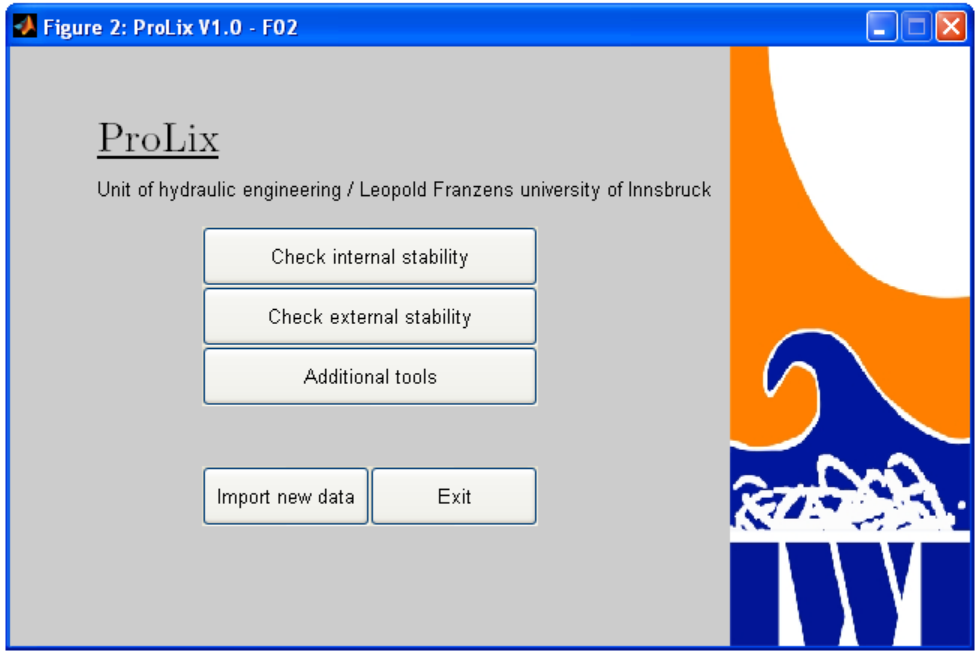
	A	B	C	D	...	...	...
1	Bezeichnung	Klasse					
2			Sieb-$\varnothing_1$	Sieb-$\varnothing_2$			Sieb-$\varnothing_{max}$
3							
4	Boden 1	Filter	0	...	...	...	100
5	Boden 2	Basis	0	...	...	...	100
...	...	...	...	...	...	...	...





Prolix

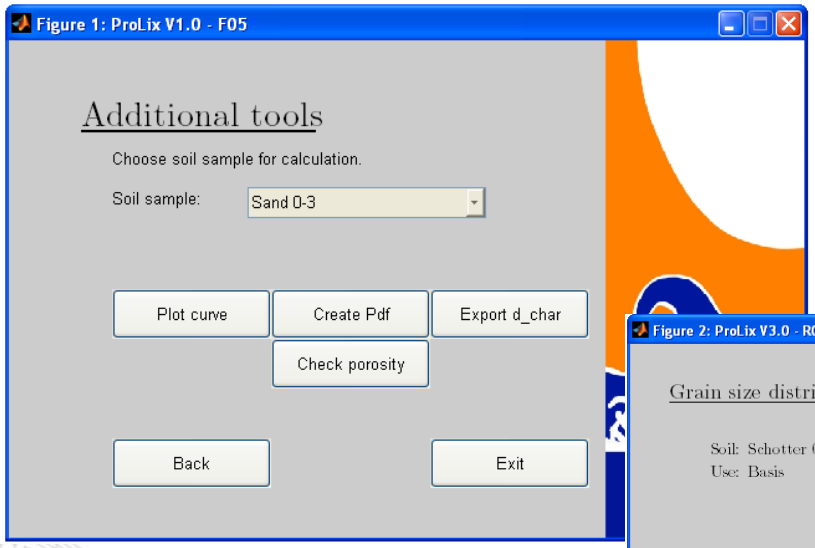
Main-Menu:

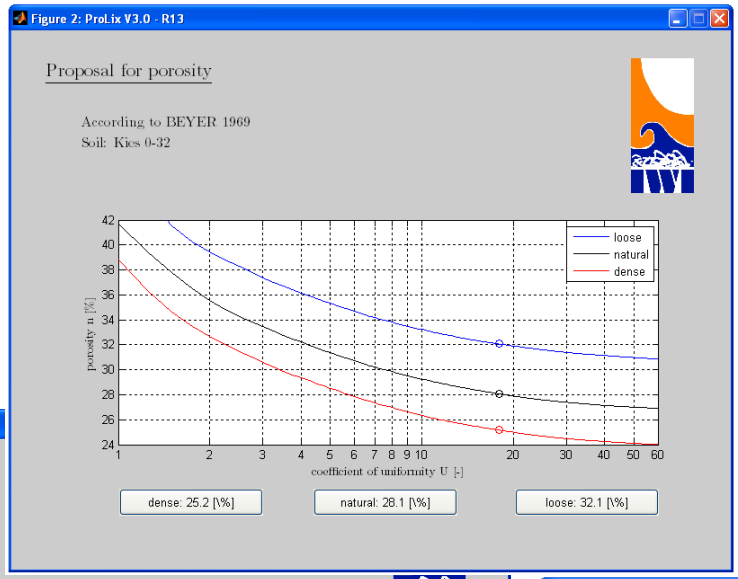


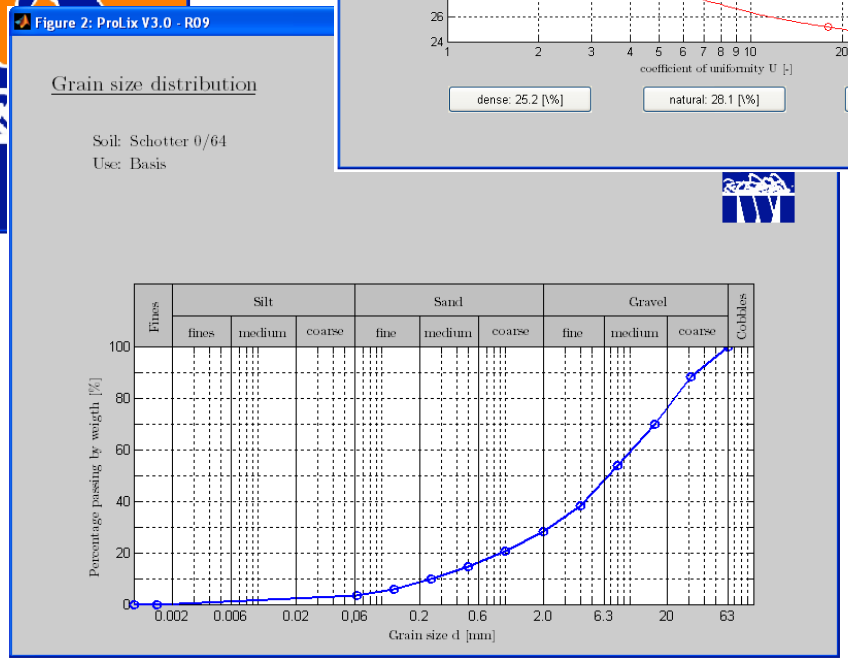
- One temporary file for all Script-files

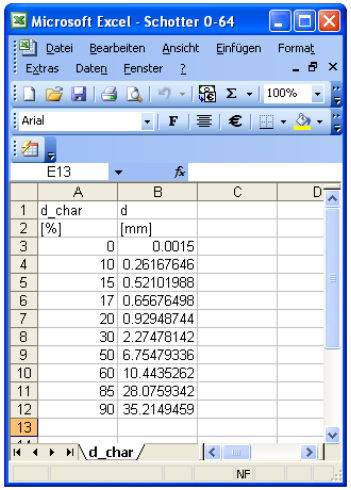
Prolix

Basic Functions:









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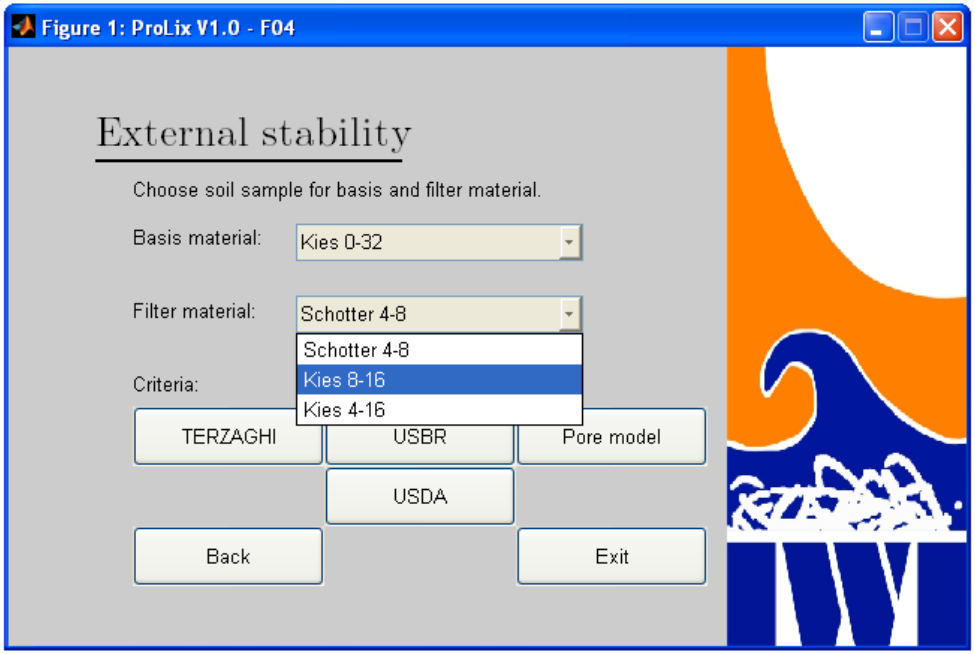
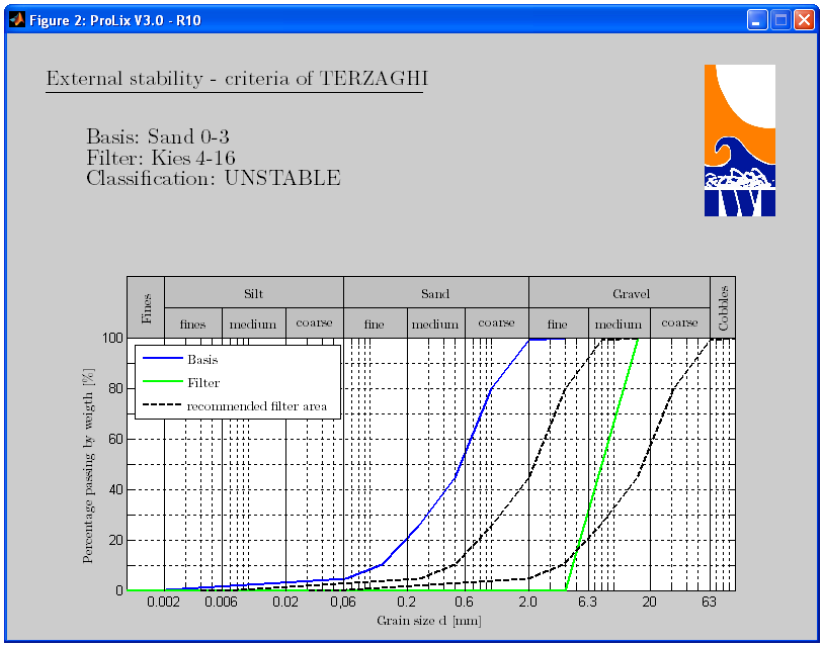
Filter criteria:

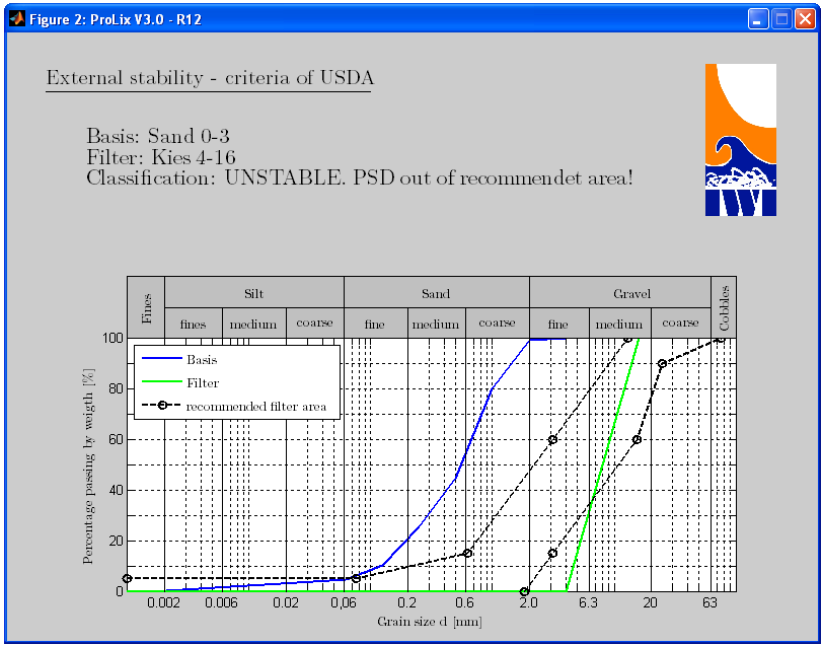


- Validate the results of the pore-model

Prolix

- Classification
- Evaluation chart





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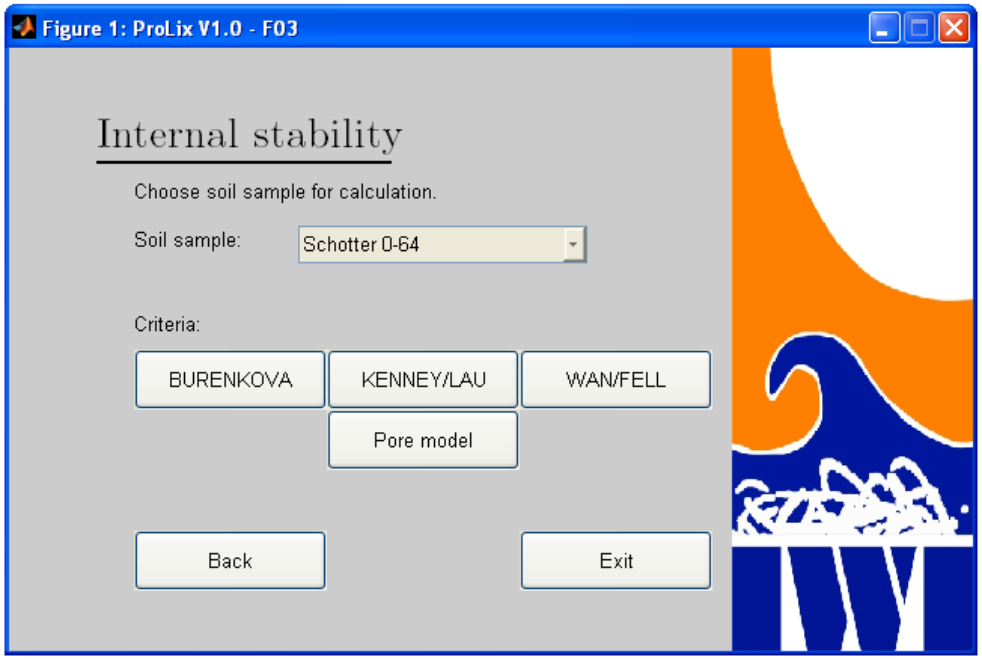
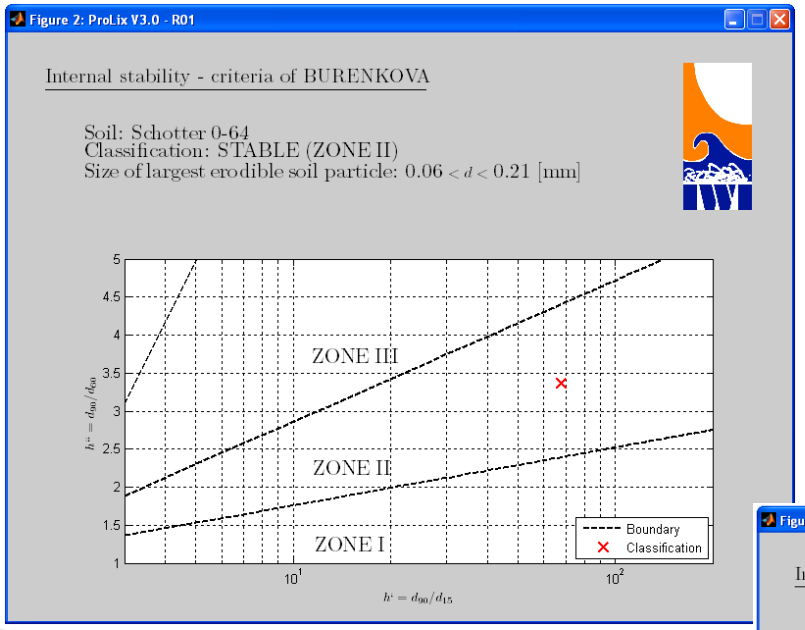
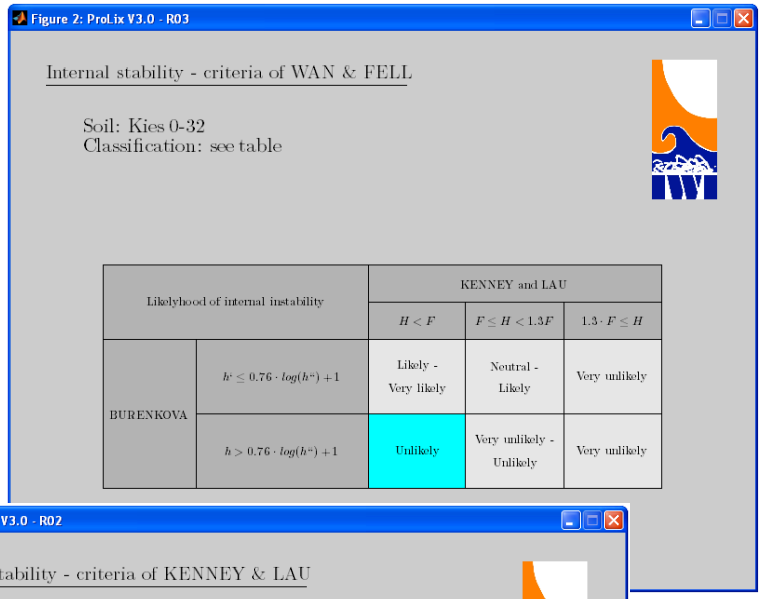
Internal stability:

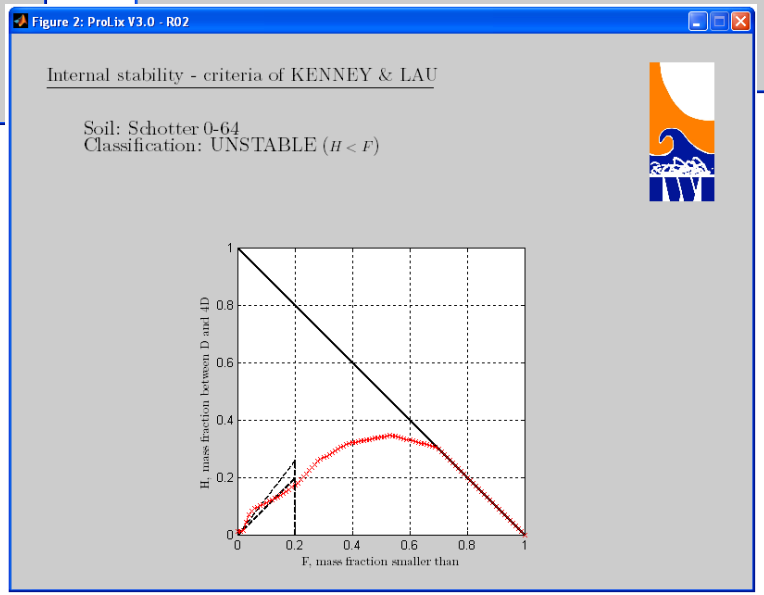


Prolix



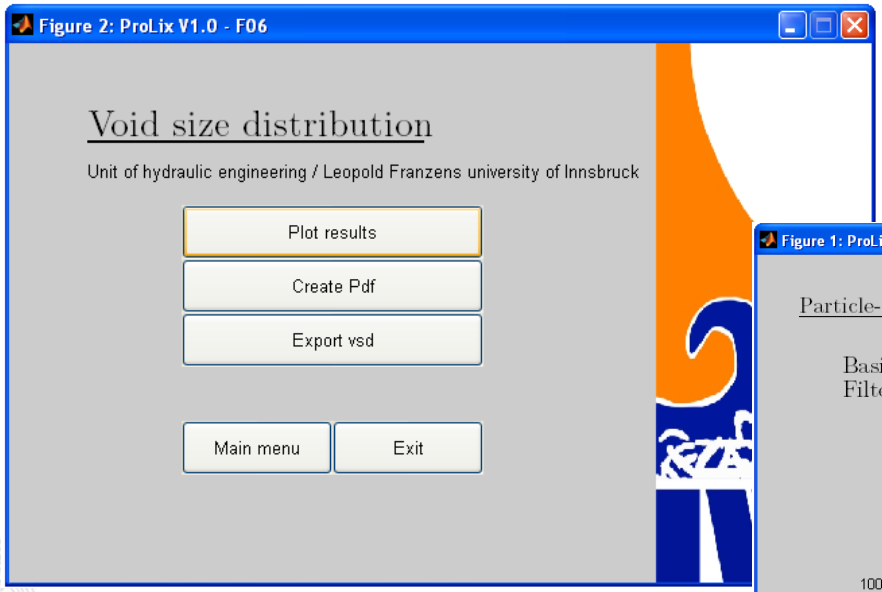


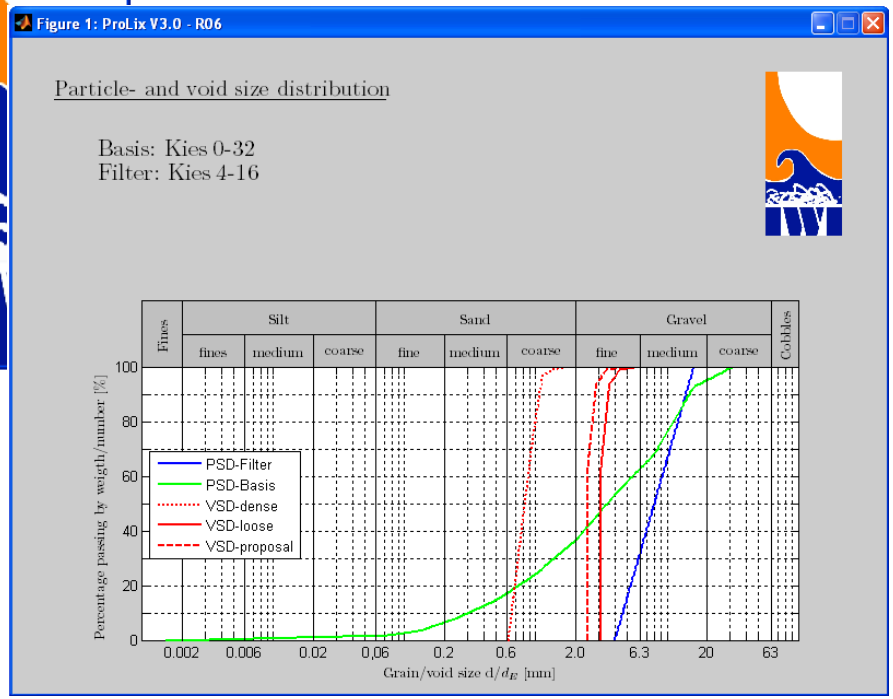
Likelyhood of internal instability		KENNEY and LAU		
		$H < F$	$F \leq H < 1.3F$	$1.3 \cdot F \leq H$
BURENKOVA	$h^* \leq 0.76 \cdot log(h^*) + 1$	Likely - Very likely	Neutral - Likely	Very unlikely
	$h > 0.76 \cdot log(h^*) + 1$	Unlikely	Very unlikely - Unlikely	Very unlikely



Prolix

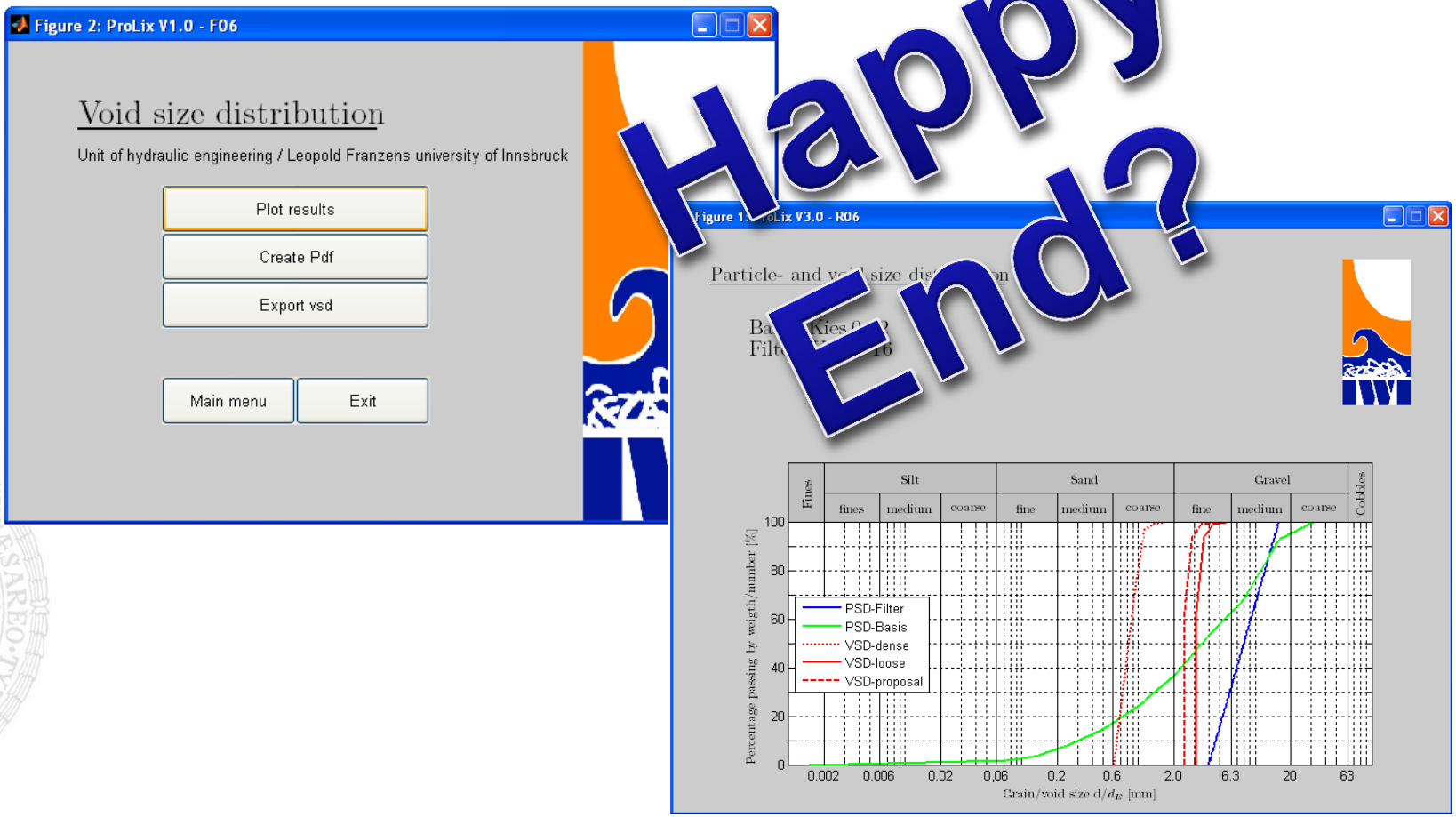
Void size distribution





Prolix

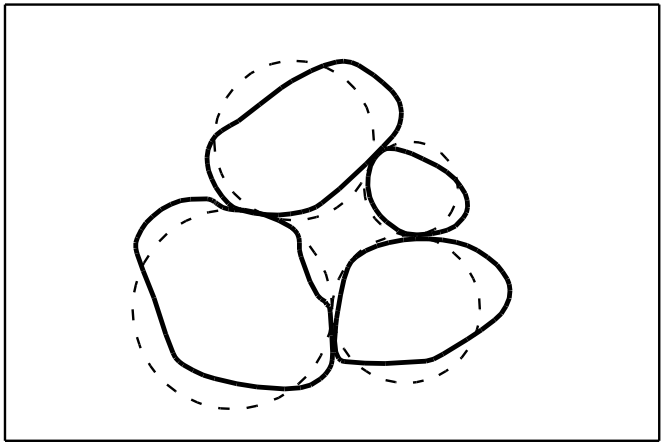
Void size distribution



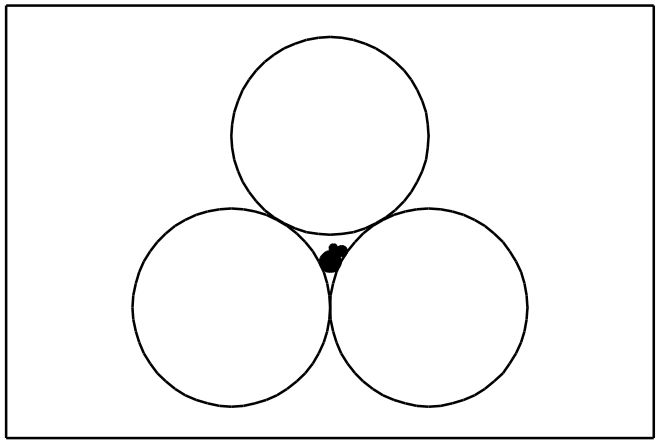
Conclusions

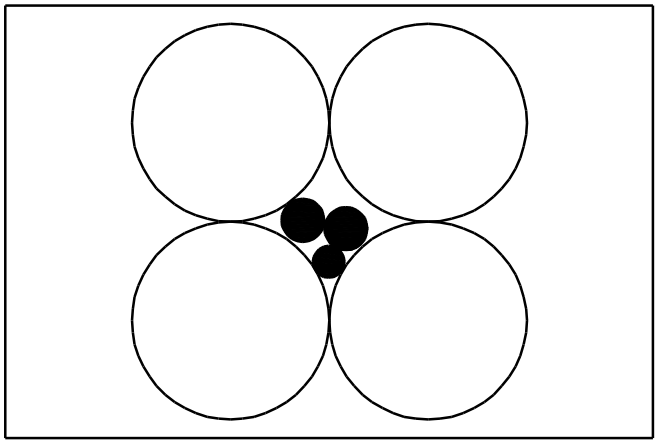
Limitations of pore-model:

- Shape of grains



- Range of diameters





Conclusions

- Further work on pore-model is needed
- Experimental data to calibrate the model
- Prolix-Software => Tool for standard calculations
- Good starting point for further develpoment

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www.uibk.ac.at/wasserbau

Thank You for Your Attention!

Thomas.Etzer@uibk.ac.at