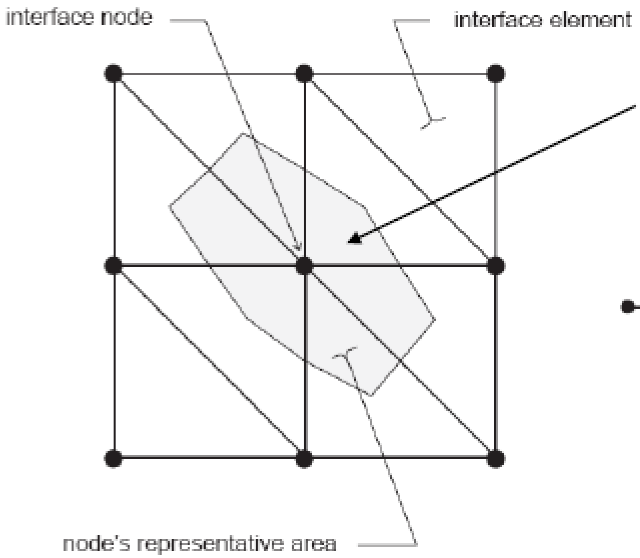
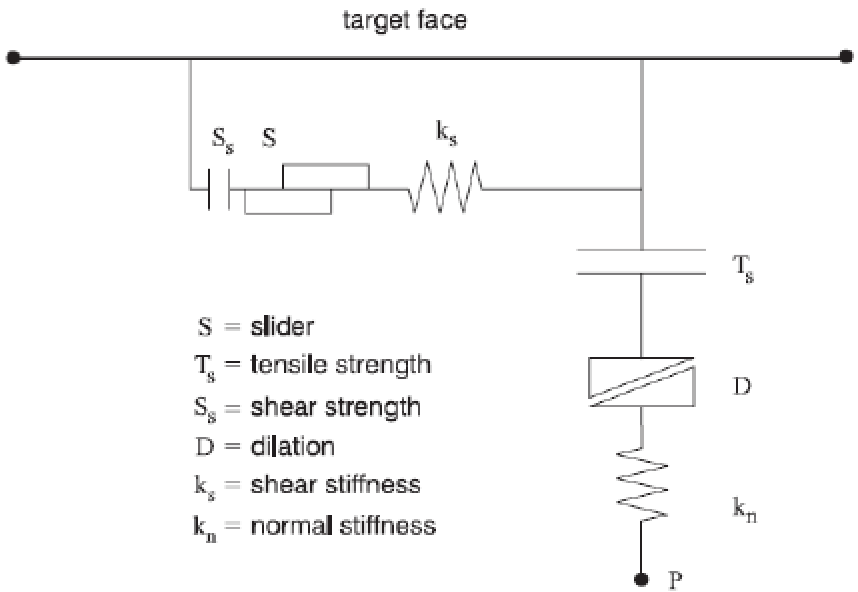
Interfaces

CIVIL ● MANUFACTURING ● MINING ● OIL & GAS ● POWER GENERATION

Interfaces in *FLAC3D*



Distribution of representative areas to interface nodes



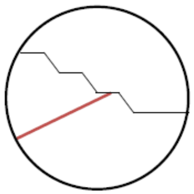
Components of interface constitutive model

Interfaces in *FLAC3D*

Discontinuities

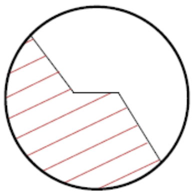
Interface

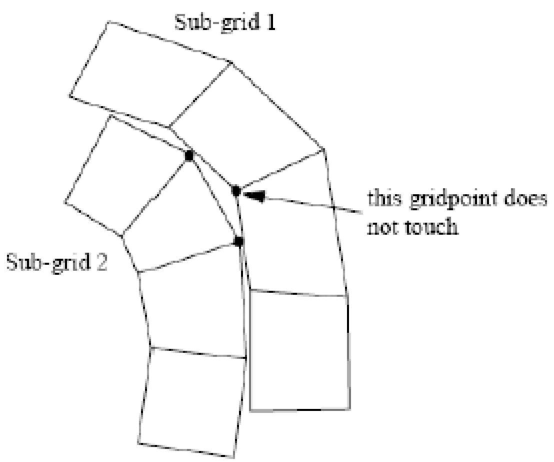
- Single or isolated
- Joint, fault, bedding plane
- Interface command



Ubiquitous Jointing

- Many or multiple
- Closely-packed blocks, fabric
- Material model





Interface Stiffness

The choice of interface stiffnesses depends on the nature of the interface. We identify three cases:

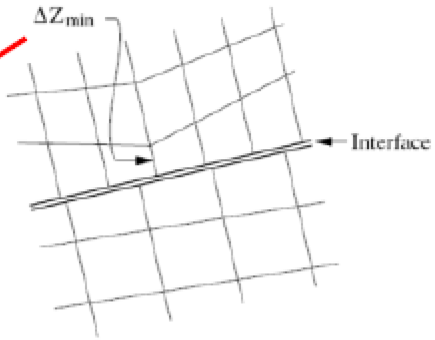
1. An artificial device to join two grids together.
2. A real interface, but one that just needs to provide mechanisms of slip and opening; the elastic deformation is unimportant.
3. A real interface for which the deformability is important – for example, a fault with clay filling.

Interface Stiffness

- For the first two cases we simply need to minimize penetration, so a normal stiffness is chosen that is large compared to the adjacent material. In the case of sub-grids, we use the following formula.

$$k_n = 10.\max\left[\frac{K + \frac{4}{3}G}{\Delta z_{\min}}\right]$$

smallest height
of adjacent zone



- For the third case, we choose the actual stiffness, recorded in physical tests on the interface material.

Interface Conditions

- **Glued Interface:** No slip or separation is allowed, but elastic displacement, defined by kn and ks, occurs.

- **Unbonded Interface:** Slip occurs as defined by Coulomb shear-strength criterion (and including dilation at onset of slip). The interface has zero tensile bond strength.

- **Bonded Interface:** It a tensile bond (**tbond**) strength is specified, the interface acts as if glued while the normal stress is below the bond strength. If magnitude of normal stress exceeds bond strength, the bond "breaks" (**tbond** is set to zero) and the interface behaves as an unbonded interface.

- A shear bond strength is also specified when **tbond** is set, in which case the bond will break if either the shear stress exceeds the shear bond strength (**sbratio*tbond**) or the normal stress exceeds the normal bond strength (**tbond**). The interface then reverts to unbonded. (By default, **sbratio** = 100.)

- If **bslip=on** is specified, slip (defined by the Coulomb criterion) can occur even though the interface is still bonded. Dilation is suppressed in this case.

Interface Conditions

- The complete interaction between interfaces and groundwater is not modeled. In particular:
  - Fluid flows without resistance across the normal direction of two sub-grids joined by an interface.
  - Flow within the interface (e.g., joint flow) is not modeled.
  - The mean pore pressure (average of sides A and B) is used to compute an effective normal stress, for slip and tensile failure calculations.
  - There is no coupling between movement & pore pressure.
  - An interface between a beam and a grid is impermeable. (An extra dummy interface – with zero stiffnesses – between two grids sandwiching a beam forces groundwater to flow across the grid-beam-grid structure).
- If this any of the above are important, consider using ***UDEC*** instead.