ROCK FALL DETACHMENT MECHANISMS

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Many classifications of rock slope failure mechanisms do not distinguish between failure or detachment mechanism and the possible run out (e.g. rock fall). As the failure mechanism influences the stability, the run out affects the hazard for settlements etc. initiated by a failure. An ideal model should therefore simulate both the failure mechanism and the run out, because the detachment mechanism has essential influence on the path, distance and deposit of the run out. At the moment we do not have such a model and thus we have to establish a mechanically correct model for the failure mechanism and - based on its results – a model for the run out.

The failure mechanism is determined by the geological setting and the geometry of the slope, the joint structure, the habitus of the rock blocks, as well as the mechanical behaviour of the rocks and of the rock mass (deformation and strength parameters).

In a small scale, in most cases falling (Fig.1a), sliding (Fig.1b), rotation of rock blocks (Fig.1g), buckling (Fig.1h) or toppling (Fig.1i and 1j) cause rock fall. In a big scale, the rock in mass movements is loosened and the displacements of a mass movement front often actuate rock fall. Thus, additionally to the mentioned mechanisms,

- Sliding of several rock blocks on a polygonal sliding plane (Fig.1c),
- Rock slumping (Fig.1d),
- Rotational sliding of a fractional body on a shelly, newly formed sliding surface (circular failure; Fig.1e),
- Translational or rotational descent of tower– or slab-shaped blocks of competent rock upon an incompetent base (Fig.1f),
- Slope creep (Fig.1k) as well as
- Kink band slumping (Fig.1l)

can cause rock fall mostly triggered by reduction of strength (e.g. due to weathering), rock mass rotations, thermal stresses, water and ice pressures in joints or vibrations (e.g. earthquakes).

The paper shows examples of the rock fall detachment mechanisms mentioned above as well as factors influencing those mechanisms.

When rock is falling, very seldom only one rock block is moving downwards. Thus the block – block interaction additionally to sliding, rolling and bouncing of single blocks has to be taken into account when rock fall run outs are analyzed. The physical relations necessary to simulate falls of several rock blocks were implemented into PFC3D (Preh & Poisel, 2007). Taking the examples Punta Thurwieser Rock Avalanche and Frank Slide the discontinuum

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mechanics numerical code PFC^{3D} modified for run out modelling and the continuum mechanics numerical code DAN3D (Hungr, 1995 and 2008) are compared (Poisel, Preh & Hungr, 2008).

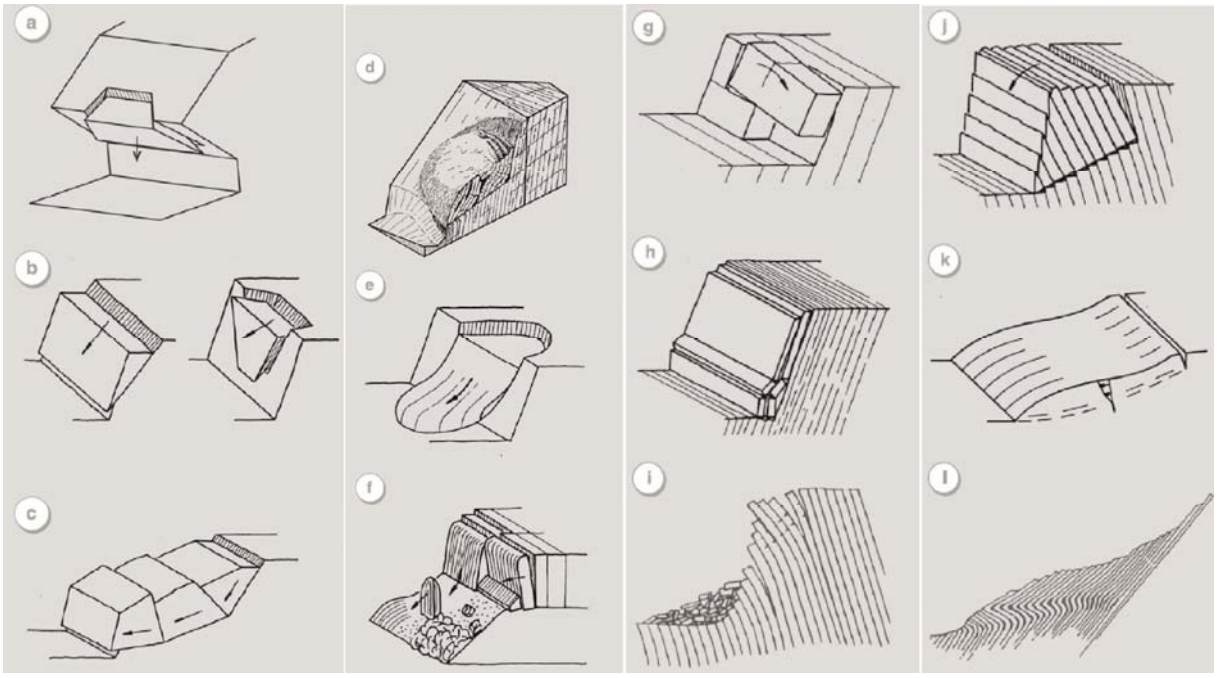

Figure 1: Rock slope failure mechanisms (from: Poisel & Preh, 2004)

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