Analysis of relationships between strike of rock discontinuities and formation position of linear depressions using finite element method

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Linear depression is formed on mountain slopes under the constraints of topography, geology and stress field. Therefore, investigating linear depression is important for understanding mountain development. In this presentation, in order to estimate the formation position of the linear depressions, a simple model of the mountain was created and three dimensional finite element analysis was performed. The software used for the analysis is Abaqus student edition 2016 (Simula).

An idealized mountain model is set where the main ridgeline is sandwiched between valleys. The rock discontinuity plane is set in the direction perpendicular to and parallel to the ridgeline direction. Furthermore, in order to deform the mountain body, compression is applied in the direction perpendicular to and parallel to the ridgeline direction. The physical property of the mountain body is assumed to be an isotropic linear elastic body.

As a result, when the discontinuity plane is parallel to the ridgeline, the forming position of the linear depressions varies depending on the compression direction. When the compression direction is parallel to the ridgeline, opening deformation occurred at the discontinuous surface near the ridgeline. On the other hand, when the compression direction is perpendicular to the ridgeline, vertical deformation occurs along the discontinuous surface at the lower part of the slope. In addition, when the discontinuous surface is perpendicular to the ridgeline, noticeable deformation cannot be observed in the discontinuous surface regardless of the compression direction.

These results are consistent with the tendency of the strike of the linear depressions to coincide with the ridgeline and the direction of the joint. These consequences also support the fact that the linear depressions are formed all over the slope of the mountainous region.

Keywords: FEA, Linear depressions, Rock discontinuity, Mountain gravitational deformation