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Numerical and Experimental Investigation on Root Anchorage

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In more recent times, the roles played by vegetation in some specific geotechnical processes have been recognized. Vegetation may affect slope stability in many ways. The stability of slopes is governed by the load, which is the driving force that causes failure, and the resistance, which is the strength of the soil-root system. The weight of trees growing on a slope adds to the load but the roots of trees serve as a soil reinforcement and increase the resistance. In order to ensure that the weight of the trees on the slope help to enhance its stability it is required that they are planted down-slope of the neutral point. Maximum contribution is produced if the trees are located at the slope toe. Considering a typical slip circle, at this location the direction of shear force acting on the trees may be considered as close-to-vertical for the purpose of analysis. In this study, 3D numerical simulations of root anchorage have been performed to study the mechanism and the factors influencing the pull out capacity of tree roots. The investigation was performed using ABACUS finite element program. Field pull-out tests were also carried out on Melastoma malabathricum which been shown to be very suitable to be grown on slope, and the results are compared with numerical simulations. Parametric studies were also done to study the effects of factors such as root pattern, angle of inclination as well as soil properties. The results show that the 3D finite element analyses are able to approximately simulate the experimental tests. The results of the field tests, simulations and the parametric studies will be presented and discussed in more details in this paper.