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Reply to 'Comments on "Flow rule effects in the Tresca model" by H.A. Taiebat and J.P. Carter [Computers and Geotechnics 35 (2008) 500–503] by L. Andersen and J. Clausen'

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The authors thank the discussers for their interest in the paper and for pointing out the error in Eq. (5). The correct form of Eq. (5) is

$$R(\theta) = \begin{cases} s_u/\cos\theta & |\theta| \leqslant \theta_T \\ s_u/(A - B\sin 3\theta) & |\theta| > \theta_T \end{cases}$$

The constant B should be multiplied by -1 if the Lode angle θ is negative.

As stated in the paper, the main aim of the work was to highlight the effects of the (associated) flow rule on the performance of a non-linear analysis using a multi-surface yield function. The rounded yield function proposed by Abbo and Sloan [2] was used in the study since it has the advantage of drifting smoothly from the Tresca (or Mohr–Coulomb) yield surface only in the region of the vertices. Also the derivatives of the rounded yield surface are defined everywhere.

The discussers presented another method of dealing with discontinuities of the Tresca yield surface, without smoothing of the intersecting yield surfaces. It was shown that this method also results in erroneous strain prediction, as expected. Subsequently the method was modified by adding a notional stiffness in one direction. It seems that this modification prevents the stress state from being on the vertices and has an effect similar to calculation of the derivatives of the yield function adjacent to (but not at) the vertices. While many methods similar to these approaches can be used to approximate the derivatives of the yield function at the vertices, the method proposed by Abbo and Sloan [2] retains its advantages, as described previously.

The discussers compared the bearing capacity factors predicted by different models for a smooth circular footing. However, the comparison indicates that all the methods over-estimate the bearing capacity factor, and the Tresca–Mises method, which includes a greater approximation to the original Tresca plastic potential function, gives a closer prediction to the exact solution. The method proposed by the discussers shows about 7% inaccuracy as compared with the exact solution. It is the view of the authors that this numerical example fails to show how application of a more accurate flow rule in a finite element analyses will result in a better prediction.

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