II INTERNATIONAL CONFERENCE
Krasnoyarsk-St Petersburg, RUSSIA
3-6 March 2021

SUAI State University of Aerospace Instrumentation

Science & Technology City Hall

«Metrological Support of Innovative Technologies» ICMSIT-II 2021

«On problem of determining the stress state of elasto-plastic compressible area weakened by ellipsoidal cavity»

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ICMSIT

Metrological Support of Innovative Technologies

Problem statement

- Determination of the stress and strain state of the mass around cavities and recesses is important in the practice of mining, construction mechanics and other related fields.
- This paper considers a weakened by an ellipsoidal cavity under mutually perpendicular forces at infinity mass of friable material with the properties of internal friction and cohesion. The case of the limit state of friable material has the form of $f(\sigma'_{ij})=k_0+a\sigma$, where σ'_{ij} are components of the stress deviator k_0, is a cohesion coefficient, $a=tg\alpha$ is a coefficient of internal friction, α is an angle of internal friction.
- By means of the conjugation of stresses at the boundary of the elasto-plastic zone, the problem of determining the stress components in the first approximation for the elastic area was set.

Solution methods

- The problem is solved by the small parameter method, in a spherical coordinate system, in dimensionless units of length. All values having the length dimension are referred to the radius of spherical cavity .
- The conditions of conjugation of solutions for the elastic and plastic zones are used to determine the perturbed stress components in the elastic area. It is assumed that the boundary of the plastic zone Fs never crosses the cavity.
- As a result of the calculations, the stresses are obtained in the first approximation in the elastic region for a triaxially compressed space weakened by an ellipsoidal cavity.

Conclusions

Results, implementation

- In this work, the components of the stress tensor for the case of elastic zone are determined in the first approximation: three normal components and three tangent components for the mass of friable material with the properties of internal friction and cohesion, and weakened by an ellipsoidal cavity under mutually perpendicular forces at infinity.
- The results can be used in calculating the stress and strain states of areas near cavities and recesses caused by rock pressure.

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