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Comments about the paper by Amit Kumar et al. "Displacement and stress fields in a poroelastic half-space due to a concentrated force" published in the International Journal of Engineering Science and Technology (IJEST), 2012, Vol. 4, No. 6, pp. 2475–2484

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1. Introduction

The authors of paper [1] refer to papers [2, 3] by Dorovsky et al. as the source of governing equations of the poroelasticity model being studied in their paper. In papers [2, 3], according to the authors' opinion, the equations of motion of saturated porous media were obtained in terms of displacement velocities. It should also be noted that papers [2, 3] investigate nonlinear non-stationary problems, but did not consider linear static problems. The equations of motion in terms of displacements, considered in the paper by Amit Kumar et al. [1] were first introduced by Kh.Kh. Imomnazarov in paper [4] on the basis of equations of a model of continual filtration theory [2, 3]. The corresponding boundary value problem in terms of displacements was solved using the Galerkin vector by Kh.Kh. Imomnazarov et al. in [5] (published in English in 2003). Paper [1] does not contain references to [4, 5]. As the matter of fact the authors could perform these investigations independently. However, the analysis of the text of paper [1] causes one more remark.

2. The major remark

The problem statement, the method of solution, and the solution as it is presented in the paper by Amit Kumar et al. [1] fully coincide with the same in our paper [5] (see http://link.springer.com/article/10.1134/1.1598251?null). The initial, intermediate, and final equations, as well as a considerable part of the text, coincide. The coefficient $\alpha = \alpha_3\rho + K/\rho^2$ introduced in [6] and used in [5] is the same as well. The boundary condition for the pore pressure introduced in [7] and used in [5] coincides. It should be noted that this condition for pressure at the boundary in continual filtration theory [2, 5] differs from that used in the Biot model [8]: since in these theories, the pressures are determined differently, the pressure coefficient differs by the multiplier ρ_l^f/ρ (the ratio between the physical density of a saturating fluid, ρ_l^f, and the density of saturated porous medium, ρ) and makes it possible to obtain the boundary condition for the pore pressure at a plane boundary. The method for solving the problem proposed in [4, 5] coincides with ours: the solution to the stated boundary value problem is reduced to two independent problems [4, 5]: the Mindlin problem for an elastic half-space and the Dirichlet problem for a Poisson equation.

A few statements that make paper [1] be different from [5] contain erroneous judgments. For instance, it is stated in [1, p. 2477] that as the porosity vanishes, the coefficient $\tilde{\lambda} = \lambda - \frac{K^2}{\rho^2\alpha}$ introduced in [5] tends to λ (the Lame coefficient for the elastic medium). This statement is not true. Indeed, there is a passage to the limit $\rho^2\alpha \to 2K$ (see [3, 5], where K is the compressibility coefficient of the elastic medium). Hence, it follows from the definition of $\tilde{\lambda}$ that as the porosity vanishes, we have $\tilde{\lambda} \to \lambda - K/2 = \lambda - \frac{2}{3}\mu$ (where μ is the shear modulus for the elastic medium). Therefore, Hooke's law for the elastic medium does not follow from formula (8) [1] at a vanishing porosity. A correct passage to the limit from the porous model to the elastic one is shown in [5, 9].

The novelty of paper [1] is in the choice of specific expressions of the Galerkin vector $\boldsymbol{G}$ for various simple forces and the calculation, on their basis, of concrete values of displacements and stresses.

Thus, formulas (1)–(11), (14), and (15) used in paper [1] fully coincide with formulas (1)–(11) from paper [5], the accompanying text being also the same. References to the original source are absent.

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