values of forces and coefficient of elongation (shortening) in obtaining of which "internal" instability is respectively implemented under small and large initial strain in the sphere are shown (lines of 2 and 4 of Table 1). It follows from the comparison of results of the second and fourth lines to the results of the third and fifth lines of Table 1 that the buckling of the equilibrium state of elastic homogeneous isotropic sphere on a geometric forming in case of influence of "dead" loads on its surface precedes the "internal" instability. The equilibrium state of the sphere is stable on geometric forming in case of influence of "follower" loads on the surface. Therefore, the "internal" instability occurs without preliminary forming in this case. It should be emphasized that it is clear from the formulae of critical forces and elongation that they don't depend on the geometric parameters of the sphere and buckling mode. An exhaustive explanation is given to this case (Guz 1986a). The boundary surface is one of the coordinate surfaces of the spherical system of coordinates in the considered problems. Eigen-values should not depend on the geometric parameters of the problem due to the nature of Lame's Eq. (8) (which includes derivatives of the same order) and the indicated case. The critical loads will depend on the geometric parameters (for example, thin-walled parameters) in case of considering the problems of stability of bodies bounded by several coordinate surfaces. The lack of effects of plastic and viscous properties of the material (Eqs. (14) and (15)) on the value of the critical parameters is related with the fact that inelastic deformation is incompressible due to the adopted laws of state, and inelastic deformation does not occur due to uniform compression in the initial state.

Calculation results implemented on Eqs. (25)-(28) are shown in Table 2. The data relating to the second variant of small initial strain theory is given in the numerator but in denominations - large initial strain theory.

Table 2.

ν	0	0.1	0.2	0.3	0.4	0.41	0.45
K_P^R	$\frac{-1.5}{-2.5}$	$\frac{-1.3182}{-2.1364}$	$\frac{-1.1668}{-1.8333}$	$\frac{-1.0385}{-1.5769}$	$\frac{-0.9286}{-1.3571}$	$\frac{-0.9184}{-1.3369}$	$\frac{-0.8793}{-1.2586}$
K_S^R	$\frac{-1}{-1.5}$	$\frac{-0.8636}{-1.2273}$	$\frac{-0.75}{-1}$	$\frac{-0.6538}{-0.8077}$	$\frac{-0.5714}{-0.6429}$	$\frac{-0.5638}{-0.6277}$	$\frac{-0.5345}{-0.569}$
$\frac{P_l}{\mu}$	$\frac{0.6667}{0.4}$	$\frac{0.8534}{0.5266}$	$\frac{1.1429}{0.7273}$	$\frac{1.6852}{1.1098}$	$\frac{3.2308}{2.2105}$	$\frac{3.5689}{2.4518}$	$\frac{6.2549}{4.3699}$
$\frac{P_S}{\mu}$	$\frac{0.5}{0.3333}$	$\frac{0.5789}{0.4074}$	$\frac{0.6667}{0.5}$	$\frac{0.7647}{0.6190}$	$\frac{0.875}{0.7778}$	$\frac{0.8868}{0.7966}$	$\frac{0.9355}{0.8788}$

The numbers given in lines 4 and 5 of the Table 2 show that if these values are exceeded, the conditions of Eqs. (27) and (28) aren't fulfilled within the considered variants of NLT, i.e. elastic pressure and shear waves can't be propagated in the medium with true velocity accordingly. The subscript in $P \quad l$ – indicates that these values relate to pressure and S to shear waves. Contrary to that it follows from the data of Fig. 1(a), b that velocities of pressure and shear elastic waves in the sphere are true in PREM in conditions $P \geq 2\mu$. It shows once again that the data on the physical and mechanical, acoustic and density characteristics in the theoretical models should be distributed in accordance with relevant requirements of the mechanics of deformable media with initial stress considering nonlinear laws of state. The obtained results relate to the data of the inner core. At the same time, they predict that it is necessary to process and interpret the relevant geological and geophysical data on the basis of non-linear (at least within NLT) theories considering preliminary deformation of the medium in solving the problem on the distribution of mantle and lithosphere parameters.

Data on the composition of the inner core material indicate its anisotropy (Fig. 1b) (Litasov and Shatskiy 2016). Naturally, phenomenon of "internal" instability will occur at much lower levels of loads and strain than in the isotropic approximations in the anisotropic medium because of the smallness of the shear stiffness.

It should be noted that the results presented in this article are obtained without considering the influence of temperature, the distribution of which is shown in Fig. 1(a). The consideration of temperature influence on critical values of instability worsens the situation. Buckling process is implemented at significantly lower pressure level under the influence of temperature fields. Therefore, the consideration of temperature will not provide a qualitative impact on the conclusion on the insufficiency of interpretation of geophysical data within the classical theory. The consideration of temperature is necessary to solve specific problems of the local distribution of the considered parameters.

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