Modeling of elastic-plastic deformation and “hydrocode” for anisotropic materials and auxetics

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The paper presents a mathematical model that takes into account the anisotropy of elastic properties of materials when determining the cold and thermal parts of the equation of state. Taking into account the anisotropy of elastic properties in anisotropic materials is especially important when modeling dynamic, pulsed loading, since under conditions of intense loading the type of equation of state used determines the process of destruction of the material, as well as the deformation of the destroyed material under compression conditions. The proposed mathematical model, implemented within the framework of the dynamic finite element method, takes into account the anisotropy of elastic characteristics and the anisotropy of the propagation velocities of elastic waves, the anisotropy of the characteristics of the cold and thermal parts of the equation of state, and the anisotropy of the propagation velocities of plastic waves. This is especially important when studying the elastic, plastic and strength properties of single crystals and the processes of deformation and destruction of metamaterials, which are characterized not only by the anisotropy of elastic properties, but also by auxeticity. Examples of calculations in a three-dimensional formulation are given, made taking into account the anisotropy of the cold and thermal parts of the equation of state and without it.