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The disruption of celestial body such as meteoroids, cometary's fragments and asteroids is investigated by mathematical methods. The gas dynamic forces, inertial force and radiation act on the body. The main results of the paper are related to the creation of stress-strain and phase transition models and simulation of the celestial body fracture and breaking up during its flight in an atmosphere.

The velocity of the body and its ablation during the first stage of the flight in an atmosphere are determined on the basis of the solution of the system of equations of the physical theory of meteors. The body is assumed to have form of body of revolution during its flight, before break up.

We suppose flow is axial-symmetric and we introduce cylindrical or spherical system directed along the trajectory. The thermoelastic problem for a homogeneous isotropic body is solved by numerical and analytical methods. The quasi-static approximation is also used. Pressure distribution on the flying CB is known. The basic system of equation for thermoelastic behavior of CB material includes the Lame equation for displacement and the heat equation for temperature. The local fracture can arise inside the body as well as near its surface. During motion along the trajectory, the inner fractured domain of the body will be increased and expanded toward body's boundary. The whole body is supposed as fractured one when the domain of crushed material occupies an inner part of the body and includes segments of the body's surface, i.e. fractured zone occupies place extended from one side of the body's surface to an opposite side. It's mean that entire body is divided into two (or more) pieces of uncrushed material and the crushed volume, which is significant part of the initial body's volume. Four criteria of fracture have been used in the calculation. The developed methods were applied to simulate the flight and disrupter of icy bodies (fragments of comet heads), stone CB and metallic meteorites. Comparisons with observation data were made for real events.