The model of propagation of acoustic signal on water surface with precipitated aerosol particles

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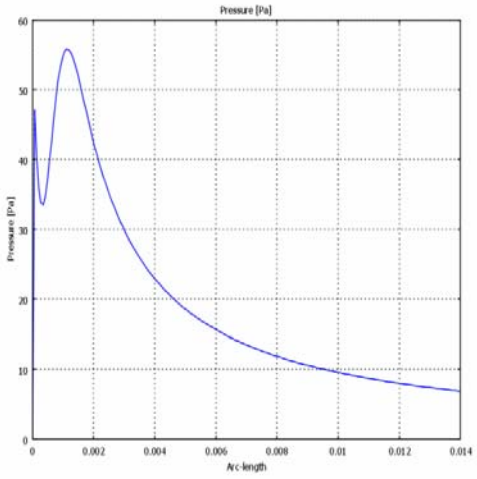
It is well known that one of main mechanism of the atmospheric purification is the precipitation of aerosol particles. The precipitation takes place both on forests, cities, *etc* and on seas and other reservoirs. What's more, a heterogeneous on composition of atmospheric precipitation takes place as a result of atmospheric migration of chemical elements. For example, the content of several metals (copper, nickel, cadmium and other) in aerosol particles increases at the transition from continental territories to coastal territories and to seas (reservoirs).

The precipitation of aerosol particles on surface of reservoirs carries out in turn to the change of the water properties. Consequently, it carries out to change of the main properties which are connected with propagation of signal of different nature. The precipitation depends on particles sizes. The large aerosol particles precipitate by gravitation soon. More small particles can fly for a long time. Consequently, such particles can spread radioactive dash.

The investigation of the propagation of signals in water with new the surface properties may be carry out with the using of electromagnetic radiation.

In given work we considered the following model problem. The collective of spherical particles was situated on the surface of the liquid (water). The water surface was modelled by two ways: 1) the plane; 2) the wave surface corresponded with the solutions of the KdV equation (the breather and the cnoidal waves). In second case the displacement of the particles relatively to position on the plane takes place. The interaction of the Gaussian beam of the electromagnetic wave with the water surface without disperse particles and with disperse particles was considered. On the basis of the Mie theory were determined the internal electromagnetic field of disperse particles and absorbed energy. After the determination of the energy it is possible to find the heat source for the determination the temperature of particles and the medium (water in given case). The heat source q_i is defined on the base of an electrodynamics problem decision: $q_i = 4\pi n_{ri} n_{pi} \left|\vec{E}\right|^2 I / n_m \lambda$, where n_{ri} and n_{pi} are indexes of refraction and absorption coefficient of the matter of the particle *j* accordingly, $\left|\vec{E}\right|^2$ is the square of the amplitude of the electric vector, *I* is the intensity of the initiative radiation, n_m is the index of environment refraction, λ is an electromagnetic initiative radiation wave length. In this case when particle is nearby other particle we use the theory of group presentation for the determination of the absorbed energy (Uvarova *et al*, 2006). The determined energy permits to calculate the temperature *T* of particles on the basis of the heat non-stationary equation. Further we considered the change of the pressure and, consequently, the propagation of the acoustic signal. The solution of the given problem we carried out by the finite element method and some analytical results.

The carried out calculation were shown that the disperse layer on the surface of the liquid affects on the character of the propagated acoustic signals.



On figures are represented the example of the solution for the pressure (on axis OY) from product of distance *x* on angle in radian (on axis OX) in water with small particles of aluminium, the power of laser radiation is 10^8Wt/m^2. The carried out calculation were shown that for different metal particles the propagation of the acoustic signal depends from the geometry of the system, substance of particle and physical property of the medium. For example, the peak of acoustic signal for iron particles appears more than for aluminium ones. Consequently, the exchange in system "atmosphere – water basin" can carry out to the change of properties of surface layer, velocity and other physical characteristics of the propagated signals.

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