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The advanced small angle approximation with application to the numerical radiative transfer calculations.

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A new approach to the radiative transfer equation (RTE) solution within the small angle approximation (SAA) precisely accounting for the path length dispersion [1-3],
is formulated.

Compared to previously known SAA RTE solutions, the proposed approach is more accurate and describes a number of physical effects, ignored by other SAA solutions.

Within the proposed approach, the stationary and transient solutions of the plane-parallel problem for the RTE and vectorial RTE are derived.

The approximate solutions for the fundamental radiation sources (point isotropic and point directed) in the medium with highly anisotropic scattering are derived and analyzed.

The numerical simulation results for the aircraft landing laser beacons and naval laser beacons in the fog are presented and discussed.

The possibility of incorporation of the proposed SAA solutions in the RTE numerical schemes for regularization of the numerical instabilities due to singularities and angular anisotropy of the solution is shown.

The problem of the coherent backscattering enhancement in the medium with highly forward peaked scattering phase function is considered within the proposed approach [4]. The algorithm is developed,
the numerical solutions are evaluated and discussed.

References.

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4. Ya. A. Ilyushin Coherent backscattering enhancement in highly anisotropically scattering media: numerical solution. Journal of Quantitative Spectroscopy and Radiative Transfer, http://dx.doi.org/10.1016/j.jqsrt.2011.12.003