In the course of the present project, physical models and numerical methods for flows with gas/liquid (fluidic) interfaces subjected to motion due to the mean velocity field and its turbulent fluctuations will be developed and studied. Surprisingly, most of the flows in the nature can be associated with such conditions, surfaces of rivers, oceans or clouds where fluctuations of interfaces enhance transport processes of heat and mass; or rain drops breaking into the smaller droplets due to shear caused by turbulent winds contributing to local weather changes. Similarly in technically relevant applications, e.g. at initial stages of ice creation on aircraft elements, during break-up of fuel jets in an internal combustion engine or in chemical reactors, transport processes involving fluidic interfaces play a crucial role.

In the present project, the numerical techniques for recently proposed mathematical model of the interface transported in the averaged turbulent velocity field, agitated by its fluctuations will be introduced and developed. This new modeling framework, based on the conservative level-set method, combines statistical and deterministic description of the evolving fluidic interfaces. Such description of the fluidic interfaces has not been used in the extant literature in numerical models of turbulence-interface interactions, hence it is the new element of the present project.

At present, deterministic models of evolving fluidic interfaces are used in the direct numerical simulations (DNS) which should be able to resolve the broad range of time and length scales, typically present in the turbulent multiphase flows. However, as the DNS studies of large-scale two-phase flow problems are not feasible due to the computational costs involved, the reduced description is needed. The development and validation of such reduced model is the primary objective of the present project.