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Particles Located on a Planar Free-Surface-Hydrodynamic Interactions in Quasi-Two-Dimensional System

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The system of many spherical particles, which are suspended in a quiescent fluid and which touch a planar free surface is considered. A method to evaluate the friction and mobility matrices for such a quasi-two-dimensional system is developed. In this approach, the irreducible multipole expansion is applied. Moreover, the free surface boundary conditions are taken into account with the use of the method of images. The essential element of this scheme is construction of an operator, which determines reaction of a single sphere (located at the free surface) on an external ambient fluid flow. This quasi-two-dimensional one-sphere resistance operator is next calculated numerically. The long-distance leading terms of the two-sphere quasi-two-dimensional mobility matrix are evaluated up to the terms of the order of $1/r^3$, where r is the interparticle distance.

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