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New integral equation for surface gravity waves in an ideal fluid

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Disturbances describing by Euler-D'Alembert equations are analyzed. Shapes of stationary surfaces gravity waves propagating in an ideal fluid are calculated basing on new integral equation defining pseudo stream function as functional of the surface elevation and its derivatives. The integral equation is valid for description of arbitrary wave amplitudes and can be applied for shallow and deep waters. Wave elevations are limited by the stability condition, troughs are limited only by the depth of a fluid layer. From condition of nullification of terms of second and higher orders of magnitude in this expression follows well-known dispersive relations for infinitesimal waves. Solutions in the form of infinitesimal and non-linear Stokes waves as well as Russell solitons are also derived from the equation. The integral equation is used for calculation of new types of stationary disturbances propagating along a free surface. For example, conditions of Russell coupled regular and randomized multisolitons propagations are presented