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Determining surface divergence in free-surface flows: convergence and solution of a nonlinear Volterra-type integral equation TIANYI LI, Univ of Minnesota - Twin Cities, ANDREW SZERI, Univ of British Columbia, LIAN SHEN, Univ of Minnesota - Twin Cities — The transport of scalar quantities underneath a free surface is of interest to many interfacial transfer applications. While surface thermal quantities such as temperature and heat flux are relatively easy to measure, the interfacial flux of dissolved gases is much more challenging to quantify Deducing the fluid motions from the data of surface thermal quantities may offer new physical insights into the correlation between free-surface turbulent flows and scalar transport dynamics and can also provide a powerful method for measuring and modeling interfacial gas flux. In this study, we analyze a nonlinear singular Volterra-type integral equation proposed by Szeri (J. Geophys. Res. Oceans, 122, no. 4 (2017): 2781-2794) for calculating surface divergence based on surface temperature and heat flux. We prove the local linear convergence of the corresponding Picard iteration method and derive the rate of convergence explicitly. Numerical examples are provided to validate the convergence performance of the method.

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