J. Math. Soc. Japan
Vol. 38, No. 3, 1986

Nonstationary free boundary problem for perfect fluid with surface tension

By Hisashi OKAMOTO

(Received Nov. 29, 1984)

§ 1. Introduction.

We consider a free boundary problem for a nonstationary motion of perfect fluid, which is a model for a flow around a celestial body. We consider only the flow in the plane through the equator. Hence the flow is regarded as a two-dimensional one. For simplicity we assume that the fluid is incompressible, inviscid and irrotational. We also assume that the equator Γ is a unit circle in $\boldsymbol{R}^2$. Self-gravitation of the fluid is neglected and only the gravitation due to the inside of Γ is taken into account. We then look for a time-dependent closed Jordan curve $\gamma(t)$ outside Γ, which, together with Γ, encloses the fluid (see Fig. I) and at the same time look for a stream function V and the pressure P of the fluid. The curve $\gamma(t)$ is assumed to be represented as

$$\gamma(t) = \{(r, \theta) \in \boldsymbol{R}^2 \ ; \ r = \gamma(t, \theta), \ 0 \leqq \theta < 2\pi\},$$

where $\gamma(\cdot, \cdot)$ is a positive function satisfying $\gamma(t, \theta) > 1$. Then the problem to be considered here is formulated as follows.

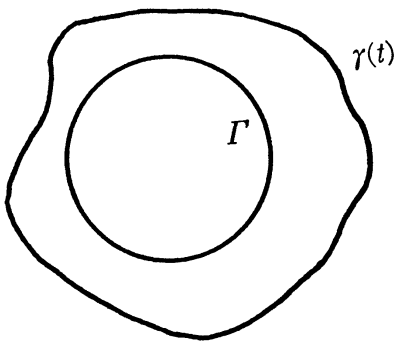

Figure I.

This work was partially supported by the Fûjukai Foundation.