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LOCALIZED INDUCTION EQUATION AND TRANSPORT PROPERTIES FOR STRETCHED VORTEX FILAMENT

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Abstract. The localized induction equation for the stretched vortex filament is reviewed. The transport of the momentum and the angular momentum carried by the stretching vortex filament is studied. The generalizations of the equation are considered.

1. Introduction

In this paper we would like to review our previous works on the generalizations of the **localized induction equation** (LIE) for the stretched vortex filament [4, 5, 6] and to study the momentum and the angular momentum transport by the stretched vortex filament.

Motion of the thin vortex filament is one of the important subject in fluid motion. Arms and Hama [1] derived the LIE for the filament as

$$\boldsymbol{R}_t = \frac{\boldsymbol{R}_s \times \boldsymbol{R}_{ss}}{|\boldsymbol{R}_s|^3} \tag{1}$$

by using the localized induction approximation. Here s is the parameter along the filament and t is the time. If $|\boldsymbol{R}_s| = 1$, then (1) becomes

$$\boldsymbol{R}_t = \boldsymbol{R}_s \times \boldsymbol{R}_{ss}. \tag{2}$$

In this case s denotes the arclength along the filament. The condition $|\boldsymbol{R}_s| = 1$ means that the filament has no stretch [7]. Then, we call, hereafter, (2) as a LIE and (1) the stretching LIE. It is known that LIE is an integrable equation and has N soliton solution. Konno and Kakuhata [4] have found that the stretching LIE is also integrable. So we will discuss the connection between (1) and (2) and study the transport properties of the stretched vortex filament.