52(1): Vorticity and the Homogeneous Field Equation of Kambe

The homogeneous field equation of Kambe is:

$$\underline{\nabla} \times \underline{E} + \frac{\partial \underline{w}}{\partial t} = \underline{0} \quad -(1)$$

and the vorticity equation is:

$$\frac{\partial \underline{w}}{\partial t} + \underline{\nabla} \times (\underline{w} \times \underline{v}) = \underline{0} \quad -(2)$$

Here $\underline{E}$ is the fluid electric field of Kambe and $\underline{w}$ is the vorticity:

$$\underline{w} = \underline{\nabla} \times \underline{v}. \quad -(3)$$

From eqs. (1) and (2):

$$\underline{\nabla} \times \underline{E} - \underline{\nabla} \times (\underline{w} \times \underline{v}) = \underline{0} \quad -(4)$$

so

$$\boxed{\underline{E} = \underline{w} \times \underline{v}} \quad -(5)$$

In the presence of a Reynolds number:

$$\frac{\partial \underline{w}}{\partial t} + \underline{\nabla} \times (\underline{w} \times \underline{v}) = \frac{1}{R} \nabla^2 \underline{w} \quad -(6)$$

so

$$\frac{\partial \underline{w}}{\partial t} = \frac{1}{R} \nabla^2 \underline{w} \times (\underline{w} \times \underline{v}) \quad -(7)$$

$$= -\frac{1}{R} \underline{\nabla} \times (\underline{\nabla} \times \underline{w}) - \underline{\nabla} \times (\underline{w} \times \underline{v})$$

However, eq. (1) is still true, and the right hand side of eq. (1) is still zero, so the Reynolds number does not indicate a magnetic monopole.