

## Coriolis Waves and Stratification Waves: a similarity of viscosity contribution in the dissipation of energy

Andrei Giniatouline, Universidad de los Andes, Colombia.

### ABSTRACT

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We consider a PDE system which describes the rotational movement of a viscous fluid

$$(1) \quad \begin{cases} \frac{\partial \vec{v}}{\partial t} + \vec{\omega} \times \vec{v} - \mu \Delta \vec{v} + \nabla p = 0 \\ \operatorname{div} \vec{v} = 0 \end{cases}$$

together with the PDE system describing small displacements of an exponentially stratified viscous fluid in the gravity field

$$(2) \quad \begin{cases} \rho_* \frac{\partial \vec{v}}{\partial t} + \vec{e}_3 g \rho - \mu \Delta \vec{v} + \nabla p = 0 \\ \frac{\partial \rho}{\partial t} - \frac{N^2 \rho_*}{g} v_3 = 0 \\ \operatorname{div} \vec{v} = 0 \end{cases}$$

For system (1) with  $\mu = 0$  we study the problem of normal vibrations ( $\vec{v} = u(x) e^{-\lambda t}$ ) where we investigate the spectral structure of the problem and establish an explicit relation between the essential spectrum and the non-uniqueness of the solutions [MG1].

The solutions of (1) possess the remarkable asymptotic property [M]: the velocity field  $\vec{v}$  decreases like  $t^{-\frac{5}{2}}$  as  $t \rightarrow \infty$ , where the viscosity decay is  $t^{-\frac{3}{2}}$  and the rotational contribution is  $t^{-1}$ .

We prove [MG2], [G] that for system (2) analogous distribution of energy takes place:  $t^{-\frac{3}{2}}$  is the viscosity contribution and  $t^{-1}$  is the gravitational decay. We also examine other properties of solutions of (2), such as smoothness and unicity, for some particular problems.

### References

- [MG1] V. Maslennikova, A. Giniatouline, *Spectral properties of operators for systems of the hydrodynamics...* Siberian Math. Journal, **29** (1988), no. 5, 812–824.
- [M] V. Maslennikova, *On the asymptotic decay of solutions of Sobolev system with viscosity.* Mat. Sbornik **92(134)** (1973), no.4(12), 49–60. (in Russian)
- [MG2] V. Maslennikova, A. Giniatouline, *On the intrusion problem in a viscous stratified fluid...* Mathematical Notes, **51** (1992), no.3-4, 374–379.
- [G] A. Giniatouline, *On the uniqueness of solutions in the class of increasing functions...* Revista Colombiana de Matemáticas, **31** (1997), no.2, 71–76.
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**Contact Address:** *aginiato@zeus.uniandes.edu.co*