Undergraduate Thesis Report

MAP2419 – Introduction to the Graduation Project

Student: Lucas Amaral Taylor (IME-USP)

Supervisor: Prof. Dr. Breno Raphaldini Ferreira da Silva (IME-USP)

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The purpose of this report is to present the activities carried out during the month of April 2025, in the context of the Undergraduate Thesis.

1. **Definition of the theme.**

   The provisional theme defined for the work was "A Stochastic Approach to the L80 Model"[1]. The project is based on the study of the article by Chekroun et al. (2021);

2. **Bibliographic survey.**

   The main theoretical references that will underpin the development of the work were identified and selected. All are available on the **Reference** page of the report;

3. **Creation of the repository on *GitHub*.**

   In order to organize the tasks and centralize the project materials, a repository was created on *GitHub*, available at:

   https://github.com/lucasamtaylor01/Lorenz80_SDE;

   Initial reading of two fundamental articles for the theoretical basis of the project: Chekroun et al. (2017) and Chekroun et al. (2021);

4. **Seminar presentation on Mori-Zwanzig Formalism.**

   As part of the theoretical deepening activities, an introductory seminar on Mori-Zwanzig Formalism was prepared and presented, based on Chapter 09 of the book *Stochastic Tools in Mathematics and Science* (Chorin & Hald, 2013).

[1] Title subject to change

References

Chekroun, M. D., Liu, H., & McWilliams, J. C. (2017). The emergence of fast oscillations in a reduced primitive equation model and its implications for closure theories. *Computers & Fluids*, *151*, 3–22. https://doi.org/10.1016/j.compfluid.2016.07.005

Chekroun, M. D., Liu, H., & McWilliams, J. C. (2021). Stochastic rectification of fast oscillations on slow manifold closures. *Proceedings of the National Academy of Sciences*, *118*(48). https://doi.org/10.1073/pnas.2113650118

Chorin, A. J., & Hald, O. H. (2013). *Stochastic tools in mathematics and science*. Springer New York. https://doi.org/10.1007/978-1-4614-6980-3