



Waldyr Muniz Oliva and the “STABILITY OF MORSE-SMALE MAPS”

C. Grotta-Ragazzo¹ · C. Peixoto¹

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“Stability of Morse-Smale Maps” by Waldyr Muniz Oliva was originally written as a preprint of IME-USP “Relatório Técnico MAP-8301 (Jan. 1983)”. This preprint, although never published, had an immediate effect on a group of mathematicians academically associated with Jack K. Hale (Brown University), who were trying to extend the successful global theory of finite dimensional dynamical systems to infinite dimensions. The group faced the challenge of finding “a class of systems for which there was some hope of classification and yet general enough to include some interesting applications” (from the Introduction of the book cited below). The preprint was a great step in this direction. It not only presented a series of abstract conditions that were sufficient for the extension, but also a collection of examples, which were interesting from the point of view of applications, that satisfied some of the conditions and possibly all of them. The results and the examples in the preprint quickly promoted so many other publications that the preprint itself was never published. Below, we comment on two of the outcomes of this preprint.

The first one is the book “An Introduction to Infinite Dimensional Dynamical Systems- Geometric Theory” by Jack K. Hale, Luis T. Magalhães (Universidade Técnica de Lisboa, UTL), and Waldyr M. Oliva, with an appendix by Krzysztof P. Rybakowski (Technische Universität Berlin), published by Springer-Verlag in 1984. As it is written in the first paragraph of the Preface of the book: “The motivation for writing these notes came from a series of lectures of the third author on retarded functional differential equations at the Lefschetz Center for Dynamical Systems of the Division of Applied Mathematics at Brown University during the spring of 1982”. The last chapter of the

✉ C. Grotta-Ragazzo
ragazzo@usp.br

¹ Departamento de Matemática Aplicada, Instituto de Matemática e Estatística (IME), Universidade de São Paulo (USP), São Paulo, Brazil

book, which has also the title “Stability of Morse-Smale Maps”, partially presents the results in the preprint. A second edition of the book was published in 2013.

The second outcome of the preprint is the paper “Some Infinite- Dimensional Morse-Smale Systems Defined by Parabolic Partial Differential Equations”, by Daniel B. Henry, published in the Journal of Differential Equations 59, pp. 165–205 (1985). Currently, this is the second most cited work of D. B. Henry, second only to his book “Geometric theory of semilinear parabolic equations”, which is probably the most successful publication authored by a mathematician affiliated to IME-USP. The first paragraph of the paper by D. B. Henry is: “The Chafee-Infante problem [3,9] is certainly the best-understood example for the global or geometric theory of parabolic equations. But one important property has been lacking: transversality of the stable and unstable manifolds of the equilibrium points. This property is crucial in the work of Oliva on “A-structural-stability” of infinite-dimensional Morse-Smale systems, and partly in response to this implicit challenge I returned to the problem of transversality.”

W. M. Oliva has a singular academic career and “Stability of Morse-Smale Maps” was written at a turning point of it. In 1952 W. M. Oliva obtained his first undergraduate degree in Civil Engineering. During the following years he was engaged in several engineering activities, among them the design of the reinforced concrete structure of the dome of the São Paulo Metropolitan Cathedral. In 1959 he got a second undergraduate degree in Bachelor of Mathematics and in 1962 a PhD degree in Civil Engineering. All his degrees were obtained at USP. In 1959 he started teaching at the “Escola Politécnica da USP” (the School of Engineering, EPUSP) and in 1967 he became “Professor Catedrático” (Full Professor of Mathematics) at EPUSP. In 15 of January of 1970, IME was founded and Waldyr M. Oliva moved to the new Institute. During the seventies his career was focused on administrative work. He held several important positions in USP among them the directorship of IME from 1974 to 1977. In 1978 he was chosen President of USP, the most prestigious and demanding administrative position at the University. After four years in this position, he turned back to research in Mathematics and soon wrote “Stability of Morse-Smale Maps”.

W.M. Oliva did research in several areas of mathematics: differential geometry, dynamical systems in finite and in infinite dimensions, ordinary and functional differential equations, and mechanics. One finds geometrical ideas in most of his works, stemmed from his deep geometrical intuition used from calculations of thin shells of reinforced concrete to invariant manifolds of infinite dimensional dynamical systems.

In this volume “Stability of Morse-Smale Maps” is finally published. It is a piece of the history of IME-USP, and in this history Waldyr Muniz Oliva is certainly one of the most important agents, a person who not only has heightened the scientific standards of the Institute but also has radiated: dialogue, respect, and friendship.