Fields Festschrift for Vladimir Arnold's 60th Birthday

Book Review by Pierre Milman, University of Toronto

The Arnoldfest, Proceedings of a Conference in Honour of V.I.Arnold for his Sixtieth Birthday
edited by Edward Bierstone, Boris Khesin, Askold Khovanskii and Jerrold E. Marsden

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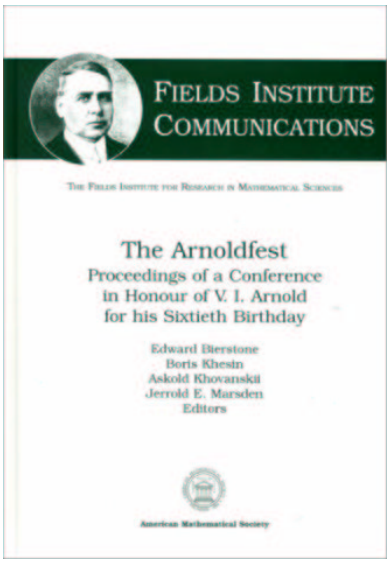

This book presents articles originating from invited talks at an exciting international conference held at The Fields Institute in Toronto celebrating the sixtieth birthday of the renowned mathematician, Vladimir Arnold. The highlight of the meeting was Arnold's own talks and the volume contains notes of his lectures including his insightful comments on Russian and Western mathematics and science. Arnold's lectures, as provocative as usual, stimulated some strong discussion. Related to this, and printed following Arnold's first lecture, is Jurgen Moser's "Recollections" article, concerning some of the history of KAM theory. The notes of Arnold's three lectures are followed, in alphabetical order, by articles by experts from all over the world, including several from "Arnold's school". The very broad spectrum of these papers reflects the scope of Arnold's interests. The articles appearing in this volume illustrate diversity in mathematics

stemming from a rather limited number of fundamental problems originally in the core of Arnold's research.

The volume includes several photos taken both during the Arnoldfest and the convocation ceremony, where Arnold was awarded an honorary degree, Doctor of Science, honoris causa, by the University of Toronto (three days before his birthday). This volume communicates esteem and warm affection for Arnold by his colleagues and former students.

Along with the titles of Arnold's lectures I include below his epigraphs because I feel they reveal Arnold's personality as it comes through in his lectures:

1. From Hilbert's Superposition Problem to Dynamical Systems.

"Some people, even though they study, but without enough zeal, and therefore live long" (Archibishop Gennady of Novgorod in a letter to Metropolitan Simon, ca 1500).

This lecture describes a personal passage of Arnold from the 13th Hilbert problem to dynamical systems.

2. Symplectization, Complexification and Mathematical Trinities.

"Augury is not algebra. The Human mind is not a prophet but a guesser. It can see the general scheme of things and draw from it deep conjectures, which are often borne out by time" (A.S. Pushkin).

This lecture is about an elusive mathematical dream that according to Arnold provided him with a transcendental guidance towards numerous interesting results.

3. Topological Problems in Wave Propagation Theory and Topological Economy Principle in Algebraic Geometry.

"From the most skillful definition, free as it might be of any inner contradictions, one can never deduce a new fact" (M. Plank, Thermodynamics).

In this lecture Arnold defines, elaborates on and illustrates in numerous examples a general principle that "the simplest algebraic realizations are topologically as simple as possible".

All of Arnold's lectures are filled with [his perception of] the historical context, deep philosophical insights into mathematical discoveries and perhaps even of prophetic guesses of mechanisms by means of which these discoveries come about.

Finally, the enormous diversity of the mathematics covered by the papers that appear in the volume, most of which contain original results, is inedicated by its table of contents starting after Arnold's third lecture:

– Geometry and control of three-wave interactions (Mark S. Alber, Gregory G. Luther, Jerrold E. Marsden, Jonathan Robbins);

– Standard basis along Samuel stratum, and implicit differentiation (Edward Bierstone and Pierre D. Milman); – A global weighted version of Bezout's theorem (James Damon);

– Real Enriques surfaces without real points and Enriques-Einstein-Hitchin 4-manifolds (Alexander Degtyarev and Viatcheslav Kharlamov);

– On the index of a vector field at an isolated singularity (W. Ebeling and S. M. Gusein-Zade);

– The exponential map on D^s_μ (David G. Ebin and Gerard Misiolek);
– Zeldovich's neutron star and the prediction of magnetic froth (Michael H. Freedman);
– Arnold conjecture and Gromov-Witten invariant for general symplectic manifolds (Kenji Fukaya and Kaoru Ono);
– Multiplicity of a zero of an analytic function on a trajectory of a vector field (Andrei Gabrielov);
– Singularity theory and symplectic topology (Alexander B. Givental);
– On enumeration of meromorphic functions on the line (V. V. Goryunov and S. K. Lando);
– Pseudoholomorphic curves and dynamics (H. Hofer and E. Zehnder);
– Bifurcation of planar and spatial polycycles: Arnold's program and its development (Yu. S. Ilyashenko and V. Yu. Kaloshin);
– Singularity which has no M-smoothing (V. M. Kharlamov, S. Yu. Orevkov and E. I. Shustin);
– Symplectic geometry on moduli spaces of holomorphic bundles over complex surfaces (Boris Khesin and Alexei Rosly);
– Newton polyhedra, a new formula for mixed volume. product of roots of a system of equations (A. Khovanskii);
– Interactions of Andronov-Hopf and Bogdanov-Takens bifurcations (William F. Langford and Kaijun Zhan);
– Solutions of the qKZB equation in tensor products of finite domensional modules over the elliptic quantum Group $E_{\tau\cdot\eta}sl_2$ (E. Mukhin and A. Varchenko);
– Schrodinger operators on graphs and symplectic geometry (S. P. Novikov);
– On the dominant Fourier modes in the series associated with separatrix splitting for an a-priori stable, three degree-of-freedom Hamiltonian system (Michael Rudnev and Stephen Wiggins);
– Homology of i-connected graphs and invariants of knots, plane arrangements, etc. (V.A. Vassiliev);
– On Arnold's variational principles in fluid mechanics (V.A. Vladimirov and K. I. Ilin);
– On functions and curves defined by ordinary differential equations (Sergei Yakovenko);
– Global finiteness properties of analytic families and algebra of their Taylor coefficients (Y. Yomdin).