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Book Reviews

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Ekranoplanes: Controlled Flight Close to the Sea

A. V. Nebylov and P. A. Wilson, WIT Press, Boston, MA, 2002, 250 pp., $348.00

An ekranoplane is a vehicle designed to fly in proximity to a ground plane. The term is derived from the Russian "ekrano" meaning screen or barrier. The notion of increasing the lift and decreasing the drag of a wing by flying in ground effect has created strong fascination for many aerodynamicists, this reviewer included. Nowhere has this fascination been more seductive than in the Soviet Union in the decades before the end of the Cold War. Indeed, the allure proved so powerful that it led Soviet leaders in the 1960s to fund construction of the KM, known in the West as the Caspian Sea Monster, which at 540 t was the largest flying vehicle of its day.

This book offers a look at the control aspects of this technology. This is not the first book to be published in the West as a result of this Soviet effort; there is also *Aerodynamics of a Lifting Surface in Extreme Ground Effect* by Kyrill Rozhdestvensky. As explained in the preface, the original Russian version of *Ekranoplanes* came out in 1994, but a chance remark at a NATO-sponsored conference in Amsterdam caused an English version to be produced. The book includes a compact disk with some rather interesting video segments of large and small ekranoplanes in flight. It is essentially two books: a nontechnical overview of this curious example of Russian development, followed by a highly technical engineering analysis of the unique control problems of these vehicles. The book succeeds to some extent with the overview, but an extremely poor translation makes the technical part almost useless.

The opening chapter discusses the history of ekranoplane development. There is a discussion of hovercraft, hydrofoils, ekranoplanes, seaplanes, and helicopters, followed by a rough calculation of the economics of operating a hypothetical fleet. In addition, two appendices give independent histories of ekranoplane development, overlapping somewhat the material in Chapter One. The second of these has a discussion of future applications. One of the more fascinating ideas is to use a giant ekranoplane as a moving takeoff-and-landing platform for a space plane. The assessment of the prospects for future development is surprisingly candid. Nebylov must have devoted a good portion of his technical career to this subject, and yet he is willing to point out that some of the theoretical advantages of this technology are not realized in practice. For instance, for a vehicle designed to operate over open water, the weight gain from deleting the requirement for a large wingspan is negated by the need for extra power during takeoff plus structural reinforcement necessitated by wave impacts.

The second chapter provides a discussion of various instruments, with a particular focus on altitude sensors. Included are radioaltimeters, acoustic altimeters, laser altimeters, and isotope altimeters. The latter is a marvelously simple concept—just hold a radioactive source above the water and measure the strength of the reflection. Unfortunately, the signal strength is a function of temperature and salinity as well as altitude, and so it was concluded that this is not an attractive concept. At the end of the chapter there is a discussion of inertial instruments, which may be of historical interest as it provides a snapshot of the state of the art of this field in Russia in the early 1990s.

The remainder of the book is an attempt to provide an engineering analysis, beginning with a Pierson–Moskovitz model of the ocean surface and ending with the relevant control theory. Unfortunately, the translation is so poor that the book has limited value as a technical resource. The reader would be better off getting a copy of the original Russian text. Somewhat mysteriously, the reference list does not include this, although there are numerous references to other works by Nebylov. All too frequently, grammatical errors and awkward phrases accumulate to the extent that the original meaning cannot be reconstructed. One of the problems encountered in translating a Russian mathematical derivation is that the Cyrillic alphabet contains 33 letters. There are at least two Russian letters that could be translated into the Roman "A." The result is that the text contains such expressions as the wave amplitude $= A(\rho, \gamma, p, A)$. In other words, the translation creates the impression that the wave amplitude is a function of itself. Evidently the publisher did not have a set of Russian fonts at his disposal. Another problem is that the math symbols in the text are converted to Roman or Greek but all the block diagrams are copies of the originals containing Russian symbols. On top of this, the poor reproduction of the diagrams turns subscripts into indistinct Cyrillic blobs. Gleaning any technical insight requires a talent for codebreaking.

This book is a British version of a Potemkin village. The cover looks very professional, but the reader does not have to go very far inside before the generally low quality becomes evident. The pictures and diagrams are fuzzy, the translation is at times incomprehensible, and the printed pages occasionally look like the output of

a copier that is running low on toner. One encounters such phrases as "the ekranoplane should have a good margin of stability and react poorly to any variation of loading. . . ." The Russians collaborated with a British publisher and a British coauthor and had a right to expect protection from such a comical translation. It is somewhat telling that the second author, P. A. Wilson, apparently did not have time to proofread his own blurb, which contains a glaring error. The book provides evidence of some very interesting work by Nebylov. It is a shame that the editors did not take seriously their responsibility to produce a readable translation.

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Tubes, Sheets and Singularities in Fluid Dynamics

Edited by K. Bajer and H. K. Moffatt, Kluwer, Dordrecht, The Netherlands, 2002, 379 pp., $105.00

This is a volume in Kluwer's series on Fluid Mechanics and Its Applications, devoted to books in which fluid mechanics plays a fundamental role. Consistent with this purpose nothing could be more fitting than to publish, as Volume 71 of this series, the proceedings of the jointly sponsored NATO-Workshop/IUTAM Symposium on Tubes, Sheets and Singularities in Fluid Dynamics, Zakopane, Poland, 2–7 September 2001, because vortex tubes and sheets can be considered as fundamental building blocks of flows at large Reynolds numbers. Their structure, stability, evolution, and nonlinear interactions are among the most intellectually challenging and important problems of modern fluid dynamics. The analogy between magnetic flux tubes, characteristic of high-magnetic-Reynolds-number magnetohydrodynamics (MHD) problems, and vortex tubes allows mutually beneficial insight into MHD and vortex dynamics and extends the applicability of such research to this domain as well.

Vortex dynamics plays a key role in the description and simulation of high-Reynolds-number turbulent shear flows, the coherent structures of which can be regarded as vortical structures evolving due to both self-induction and complex interaction with boundaries and random environments. The marked stretching by mutual interaction of nearby skewed vortex tubes can lead to very rapid growth of vorticity. The question of the development of finite-time singularities is the subject of much current analytical and computational work, and, like the other topics mentioned in the preceding paragraphs, is treated in the papers in this volume.

Specifically, the papers are grouped in the following six parts: vortex structure, stability, and evolution; singular vortex filaments; magnetic structure, topology, and reconnection; vortex structures in turbulent flow; finite-time singularity problems; and Stokes flow and singular behavior near boundaries.

The location of the meeting allowed for more papers from Eastern European contributors than might otherwise have been the case. The 40 or so papers in the volume are typically 6 pages long, the longest ones generally at most 10 or so pages. The papers are mainly theoretical, analytical, and numerical simulations, with some experimental or observational papers. Some address very specific problems, whereas others address general issues or provide concise reviews of the literature. Collectively, the authors merit considerable credit for so succinctly and effectively presenting and summarizing their contributions. An abstract at the beginning of each paper makes it easy for the reader to quickly decide which papers to read in depth. Finally, the editors, K. Bajer and H. K. Moffatt, and the publisher deserve praise for the typography of the papers, their uniformity of style and being easy on the eyes, and the brief time that was allowed to elapse between the oral presentations at the meeting and their appearance in print. This volume is an invaluable guide to the state of research in some of the most important areas of vortex dynamics at the commencement of this decade.

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