

Acoustic Control of Turbulent Jets

A. S. Ginevsky, Ye. V. Vlasov, and R. K. Karavosov, Springer-Verlag, New York, 2004, 232 pp., \$119.00

About 31 years ago, as a fresh graduate student settling to a research topic, I was given an assignment by my advisor. We had a small jet facility with the capability of imparting acoustic excitation to the flow. To get my feet wet in the research topic, I was to reproduce the experimental results of S. C. Crow and F. H. Champagne then just published in the *Journal of Fluid Mechanics*. While toiling over this task, a couple of curious effects of the excitation immediately caught our attention. One was the occurrence of a frequency-halving in the flow due to vortex pairing, and the other was a remarkable attenuation of turbulence intensities at relatively high excitation frequencies. The former went on to be the basis of my dissertation. With respect to the latter, in keeping with common experience of researchers (graduate students in particular), we found out later that others had already discovered the phenomenon. This was a time when information on foreign publications was not readily available. (Library services were nothing like we have today. Some may be surprised but it is true that we did not have access to the World Wide Web. Just to continue on that thought, our state-of-the-art lab computer occupied a full 6-ft-tall cabinet and had an incredible 32-k RAM!) It turned out that two of the authors of this book, Y. V. Vlasov and A. S. Ginevsky, had previously observed and documented the turbulence suppression effect. In fact, as described in the preface of the book, for their discovery they were awarded a U.S.S.R. state registration titled, "The phenomenon of the turbulence acoustical attenuation in subsonic jets." This particular aspect of excitation effect on shear flows is one of many that the authors have covered.

The book indeed covers a range of related topics. Chapter 1 begins with a description of coherent structure dynamics and aeroacoustics of jets. The phenomena of turbulence suppression and amplification under tonal excitation are covered in Chapter 2. Here, the influences of initial boundary-layer state and nozzle geometry are discussed. Also, results of multifrequency and multimodal excitation are summarized. Chapter 3 deals with

the impact of excitation on radiated noise from a jet. Effects of high-amplitude excitation and self-excitation are discussed in Chapters 4 and 5, respectively. Numerical simulation efforts on excited shear layers are covered in Chapter 6. Excitability of supersonic jets is addressed in Chapter 7. Several interesting experiments on jet noise reduction, primarily from the authors' own research, are discussed in Chapter 8. Resonances encountered in wind tunnels are considered in Chapter 9. Finally, Chapter 10 is devoted to resonance of flow over cavities and its alleviation. The authors draw on extensive research results of their own and others. The technical discussions are good. The coverage of other researchers' work is quite comprehensive.

Unfortunately, there are serious weaknesses in the book. I list the following to help remedial action in a possible future edition. The English translation is not good and often is difficult to read. Some of the content may have been confused in the translation. There is a lack of clarity in the presentation. Notations have been used without clear definition; for example, " St_s " for Strouhal number has been used from the beginning of Chapter 2 but a definition appears much later, in Chapter 8. Some notations have not been defined at all, and in other cases multiple notations for the same parameter have created confusion. Many figures are difficult to follow, e.g., Figs. 1.6, 2.6, 2.73, 2.75, and 5.7. Symbols at several places are missing or not legible. The book is written in the style of a "reference book"; however, the references are often unclear. For example, it is not apparent that Fig. 2.39 is actually from K. K. Ahuja's work (Ref. 2.1) rather than from Ref. 2.56. Citation of the source of the data in each of the figure captions would be desirable and helpful.

In spite of the weaknesses, I find the book interesting and useful. For researchers it should be a valuable reference book. I recommend it to them as well as practitioners in the field.

K. B. M. Q. Zaman
NASA Glenn Research Center