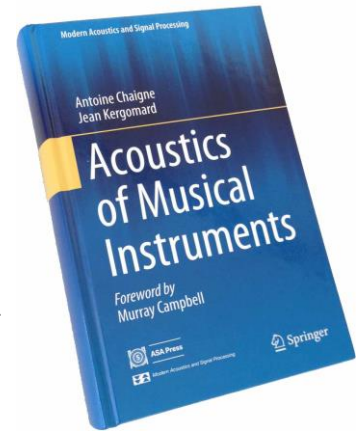


Acoustics of Musical Instruments

Antoine Chaigne, Jean Kergomard 2016 by Springer New York
ASA Press 844 Pages - 355 BW Illustrations ISBN 978-1493936779
<http://www.springer.com/cn/book/9781493936779>



Whenever someone started dealing with the physics of musical instruments he probably reached for the famous Springer book “Physics of Musical Instruments” written by Fletcher and Rossing published in 1991. Since 2016 there is an alternative. “Acoustics of Musical Instruments” written by the most renowned and widely respected scientists Antoine Chaigne and Jean Kergomard was again published by Springer in cooperation with ASA Press, a publishing organization of the Acoustical Society of America. While this new and revised book was now published in English language, a French version existed before and had its second edition in 2013.

From the covered topics and from the claims raised by the authors in the preface of the book it becomes immediately clear that this book is to become the new standard text in musical acoustics. It has more pages, it contains topics not known in the eighties when Fletcher-Rossing was written and it contains new views and most recent methodologies developed during the past 25 years of research. These views are typically more general and more abstract than the derivations given in Fletcher and Rossing. Fletcher and Rossing often started their derivations with a simple and easily understandable case, adding complexity step by step to finally end up with a fairly general analytical expression. Chaigne and Kergomard usually do the opposite. They start with most general and abstract equations describing elementary relationships between multidimensional tensors. Then they introduce symmetries, add boundary conditions and drop dimensions step by step in order to obtain all the special cases which are present in various instruments.

Without any doubt, this is the more rigorous and elegant way, but it has the drawback that the new book on musical acoustics will not supersede the old book at least not for undergraduate physics students. The new book will definitely become the primary handbook for PhD and to some extent master level students and engineers but undergraduates and non-academics might resign soon. Most of the derivations do not only require a rather good theoretical foundation in mathematics but also familiarity with quite advanced notation concepts and a significant amount of computational practice.

The book is structured in four Parts. Part I covers the basic concepts from the constitutive equations of matter, the conservation laws, numerical methods for solving differential equations in a continuum up to the single degree of freedom oscillator which got a strong focus. Part I is not directly related to musical instruments, it is rather a collection of important results in physics and mathematics which are referenced later in this book and used as a starting point for more specific derivations. This part is obviously not meant to be an introduction into the main topic and could therefore have been put into the appendix as well.

Part II deals with waves and modes with strong references to applications in musical acoustics such as plugged, struck or bowed strings or struck beams, membranes, plates and shells. It introduces into the treatment of dissipation and damping and puts some focus on coupling issues like structure-cavity and string-bridge-soundboard coupling e.g. in pianos, violins or guitars. Its last chapter deals with the analytical treatment of cylindrical, conical and flaring resonators of wind instruments including discontinuities and tone holes. Part II could have also been named “linear acoustics”.

Part III is now dedicated to nonlinearities. After covering the basic concepts and methodologies, specific nonlinearities occurring in musical instruments are addressed. This includes nonlinear wave propagation and shockwaves, nonlinear strings and geometric nonlinearities leading to chaos in gongs and cymbals. And, of course, oscillators as nonlinear feedback loops like those being part of the sound generation of wind instruments are prominently dealt with in the chapters “Reed Instruments” and “Flute-like Instruments” (authored by Benoit Fabre) and “Bowed String Instruments” (authored by Xavier Boutillon).

The title of Part IV is “Radiation and Sound-Structure Interaction”. This chapter contains an introduction into the basic theory of monopoles, dipoles and multipoles and covers in quite some depth the radiation of vibrating structures and complex systems. The complex systems which are studied are the vibraphone, the kettledrum, the guitar, the piano and wind instruments with several open tone holes.

All in all, this book is a great repository of state of the art knowledge. It is a handbook for looking-up concepts, derivations and mathematical methodologies currently developed and employed in the field of musical acoustics. The book is rather complete in a sense that it covers most recent knowledge in its field and it is very efficient in terms of space. There are absolutely no unnecessary figures or derivation steps; some more would possibly have made the derivations a bit less demanding – but the book maybe twice as thick. Anyway, all figures are very illustrative and helpful and if one is familiar with the theoretical foundations of a specific chapter he will definitely be able to follow step by step and get the point.

The bottom line: This book is a handbook and a great reference for researchers and PhD level graduate students but it is not a classical text book. If it is too heavy to digest for some readers then they might try to read Fletcher and Rossing’s book first and then come back to learn about the state of the art. It has really become high time for putting down the results of 25 years of research in musical acoustics in a single book. And it is hard to imagine finding someone more competent for this job than Chaigne and Kergomard. This book will definitely become a classic like the one by Fletcher and Rossing but it will complement and not replace it.

Wilfried Kausel, Professor in Musical Acoustics at Univ. of Music and Perf. Arts Vienna, Austria