

Preface

Musical instruments are a response to the love of music, filled with passion and excitement. Like all emotional experiences which need to be filtered by a rational approach, musical instruments call for a deeper understanding of a broad range of physical phenomena. This is why for many years I have concentrated on directing one of my scientific interests to musical instruments and to exploring their intertwined connection with materials and Materials Science.

I hope this book is a useful introduction to all of those who are interested in string musical instruments and want to discover a more profound emotional experience from listening to a beautiful piece of music played for example by a violinist on a famous instrument, which *in fine* is a precious art object. In these pages the reader will find not only scientific considerations of the behaviour of materials from which string instruments of the classic symphony orchestra are made, but also other information about the instrument makers of different periods and the historical context in which the musical instruments have been created. Some of the string instruments presented in this book evolved during periods in which craftsmen who invented, developed and perfected those instruments were most productive. I refer here to the violins built by the Italian masters and the pianoforte built by Cristofori and other pianos built during the seventeenth–nineteenth century, the classic guitar built by Torres, the pianos built by Erard and Pleyel, the harps built by Erard and Salvi, the grand piano built by Steinway, Yamaha and others and, the handmade pianos by Fazioli—Italy and Stuart—Australia, at the end of the last century. The quality of these marvels is embodied in the magnificent photographs available to generations of people in various archives. Being widely accessible the virtual gallery offers not only a well-documented journey of the famous musical instruments, both old and new, but also an invitation to the reader to discover the scientific tools that give us a deeper understanding of their acoustical qualities. It is very surprising to see that the same natural materials were used during three centuries to build so many musical instruments which are works of art, and nowadays belong to the patrimony of humanity.

At the end of the twentieth century systematic efforts were directed to the use of new composites but only for mass production. Concert instruments for soloists and instruments for professional musicians in symphony orchestras are exclusively made by craftsmen using traditional materials and technologies. The book provides insights into the properties of traditional and new materials used for building string instruments, having as one of its primary roles the understanding of ways in which materials contribute to the acoustical qualities of these instruments. Here, a book is then written from the perspective of materials science, which in my opinion, was needed as a complement to the existing books on physics and acoustics of string musical instruments. A familiarity with the current terminology used by luthiers and scholars will satisfy everyone's curiosity and enable readers to confidently deal with string instruments made by a famous or unknown luthier.

My work on this book was a labour of love, which I began in 2011. I am very grateful to the Commonwealth Scientific and Industrial Research Organisation (CSIRO)—Australia, and particularly to the Chief of the former Division of Materials Science and Engineering—Dr. Cathy Foley for sponsoring this project and for allowing me to work on this book in a supportive environment. Dr. Grahame Smith initiated this project following the long conversations we had in 2011 about materials science and classical music. At that time Dr. Grahame Smith directed the laboratory in Clayton (Melbourne) and I was Senior Visiting Scientist at CSIRO. After his retirement, Dr. Grahame Smith continued to be one of the reviewers of this book's manuscript and continued generously to help in using the complexity of the electronic approach required for copyright forms for the numerous figures of this book. I am profoundly grateful to him.

Professor Neville H. Fletcher—Australian National University, Canberra—is my mentor in the field of musical instruments acoustics. I owe him a great debt of gratitude for the enthusiastic contribution, generosity and encouragement offered to me over the 4 years of writing the manuscript comprising more than 2,000 pages. He most generously read the draft of my manuscript, offering extremely useful advice leading to the publication of this book.

I am also very grateful to Mr. Len Tosolini for the proofreading of different versions of the chapters of my manuscript. He helped enormously with his expertise in all stages of the elaboration of this book.

My special thanks are addressed to my colleague Dr. Silvia Pongracic for her continuous encouragement from the beginning to the final version of the manuscript of this book. I address my acknowledgements to Mr. Flavio Ponzi (Bologna—Italy) for his enthusiastic contribution with numerous comments related to historical pianos restoration, which improved my manuscript. I would like to acknowledge my collaboration with Mr Wayne Stuart AO—Stuart and Sons Handcrafted Grand Pianos—Australia related to the innovations in the construction of the modern handcrafted grand pianos.

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Also I would like to acknowledge my administrative coordinators at CSIRO—Mr. Andrew Tulloh and Mr. Robin Kirkham, my CSIRO colleagues sitting next to my office, Dr. Neil Sims and Dr. Glenn Newnham, for their help with electronic tools for writing the manuscript and CSIRO librarians and the librarians of the Victoria State Library. All of them were very interested in the progress of my book and very helpful in my everyday tasks related to completion of my manuscript. I sincerely thank all colleagues, musical instruments makers, museums, scientific organisations and publishers (all cited in reference lists) who permitted the use of their figures that illustrate the text of this book. This book is based on the work of many colleagues in the Musical Acoustics community, including the Australian Acoustical Society, the French Acoustical Society, the Acoustical Society of America, the Catgut Acoustical Society and the Violin Society of America, the Institute of Acoustics UK and the Australian Commonwealth Scientific and Industrial Research Organisation—as cited in this book. I have to thank them all for the interesting exchange of ideas and suggestions during international meetings since about 1985, ideas that confirmed my conviction about the necessity for this book.

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Musical instruments are indispensable to the materialisation of music. We know from the popular wisdom of a proverb that says “*la musique adoucit les mœurs*” (*music soothes the savage breast*), and we know also that music is a deep and miraculous source of joy which helps us, human beings, to live in harmony with ourselves and with our fellows.

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