

Preface

Interest in cochlear mechanics (CM) and particularly in the role of nonlinear cochlear processes expanded significantly during the 1970s. For me it was stimulated particularly through contacts with Jont Allen—a contact that remained important after his visit to Eindhoven—and Egbert de Boer, who was—amongst others—active within the Dutch Auditory Biophysics community.

My move to the University of Groningen in 1980, in combination with international developments, such as the discovery of otoacoustic emissions, led to an immediate increase in interest in CM. We followed up a proposal by Peter Johannesma [International Symposium on Hearing (ISH)—1980] stating that a Van der Pol-oscillator might be a proper model for spontaneous emissions.

At the same time significant theoretical contributions were given by John W. Matthews (1980) and Stephen T. Neely (1981) in their doctoral theses presented at Washington University. They also contributed to the ISH-1980 conference mentioned above. They started to explore nonlinear cochlea models in the frequency and time domain.

As a result, 1980 became a pivotal point in this book!

This book strongly rests on work from the Groningen biophysics department, which was largely performed by graduate students, both at master's (Sietse van Netten, Berk Hess, Johan Kruseman) and PhD levels (Marc van den Raadt, Peter van Hengel) and by postdocs (in particular Peter van Hengel). In addition, national (Max Viergever, Rob Diependaal: Delft University of Technology) and international cooperations have been essential (Bastian Epp: Carl von Ossietzky University of Oldenburg).

Within the University of Groningen we cooperated with mathematicians (Hendrik Hoogstraten, Henk Broer) and with audiologists from the ENT-department at the University Medical Center Groningen (Roel Ritsma, Hero Wit, Pim van Dijk).

Disputes and collaborations with the international community have quite effectively been controlled through the international journals as well as through meetings such as the Mechanics of Hearings conference series (started in 1984).

After formal retirement from the University of Groningen faculty, I was in the position to put our developments together in the underlying book format.¹

The book is intended for use at the graduate or postgraduate level for students with a background in (bio)physics, (electrical) engineering, applied mathematics, or related specializations and multidisciplinary interest. It is somewhat related to Dallos's *The Auditory Periphery* (1973), but much narrower in scope, and updated with respect to otoacoustic emission data and to nonlinear modeling.

The contents is divided in three parts. Part I contains a historical introduction and deals with developments of linear CMs, up to approximately 1980. Part II presents a selection of experimental nonlinear phenomena, and the time domain study of some global nonlinear models. Part III presents results and open issues. Finally, Part IV contains useful general tools and example results.

The introductory Chap. 1 relies heavily on input from Peter van Hengel. His role in the development of the program and applications is also appreciated.

The final form of this book was significantly improved by the reviewers Bastian Epp, Hero Wit, and in particular Michael Rapson.

Groningen

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References

- van den Brink G, Bilsen FA (eds, 1980) Psychophysical, physiological, and behavioural studies in hearing (ISH-80), Delft University Press, Delft
- Dallos P (1973) *The Auditory Periphery*. Academic, New York
- Matthews JW (1980) Mechanical modeling of nonlinear phenomena observed in the peripheral auditory system. PhD thesis, Washington Univ. Sever Institute of Technology, St. Louis
- Neely ST (1981) Fourth-order partition dynamics for a two-dimensional model of the cochlea. PhD thesis, Washington Univ. Sever Institute of Technology, St. Louis

¹Additional material referred to in the text by unspecified URLs is accessible through the following Springer link: <http://www.springerextras.com>.

Cochlear Mechanics

Introduction to a Time Domain Analysis of the Nonlinear
Cochlea

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2012, XIV, 262 p., Hardcover

ISBN: 978-1-4419-6116-7