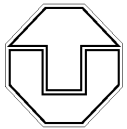

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Hearing Aid Transducers — Choices for Future Development

Matthias Blau

TU Dresden
Institut für Akustik und Sprachkommunikation
Klinik und Poliklinik für Hals-, Nasen- und Ohrenheilkunde

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2. Current State and Problems
3. Conventional Transducers
4. Other Transduction Principles
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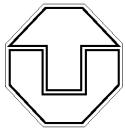
6. Concluding Remarks

1. Introduction

- development efforts of past years mainly went into signal processing and fitting strategies
- what about transducers?



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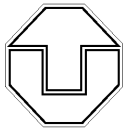
2. Current State and Problems

- miniature electromagnetic driver + sound delivery system to the ear canal (tubing and ear mold)
- transducer operates in (somehow damped) mechanical resonance
- mimics transfer characteristics of ear canal up to $\approx 5k$Hz (linear distortion by tubing/ear mold though)



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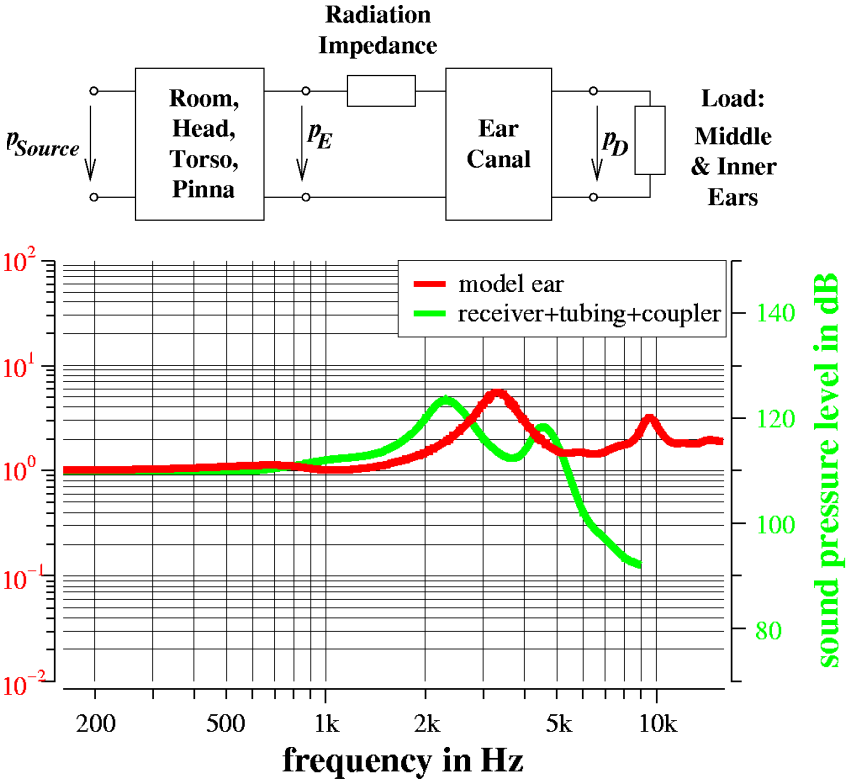

- ok for today's hearing aids
- problem: HiFi needs improved high frequency behavior

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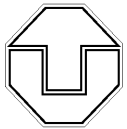

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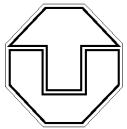
3. Conventional Transducers

- today's transducers: optimized compromise between cost, bandwidth, max SPL, distortion, size, power consumption
- more bandwidth means to sacrifice (at least) one of the other parameters
- which one would *you* choose?

4. Other Transduction Principles

- electrodynamic
  - pros: linear law, design experience from headphones
  - cons: efficiency, max SPL
- piezoelectric
  - pros: linear law, robustness, distortion
  - cons: max SPL
  - to be seen: high electrical impedance, cost



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5. Implantable Transducers

- variety of models proposed (some with FDA approval)
- very good HF response as middle ear is bypassed
- electromagnetic: Symphonix, BAHA
- piezoelectric: TICA/Otologics, St. Croix Envoy
- advantages: - HF response
  - no occlusion effect
  - no ear canal irritation
- problems: - surgery
  - long-term effects (bone & tissue reactions)
  - economic

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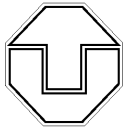
6. Concluding Remarks

- conventional transducers suffer from high frequency behavior
- extending HF response at cost of . . . ?
- alternative transduction principles?
- implantable transducers?
- need comprehensive model of electronics+transducer+sound delivery system+ear
- nonlinear distortion reduction by signal processing (mirror filtering approach)



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