

Introduction to Audio Content Analysis

Module 3.4.4: Time-Frequency Representations — Filterbanks

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introduction

overview

corresponding textbook section

Section 3.4.4

■ lecture content

- Gammatone filterbank
- resonance filterbank

■ learning objectives

- explaining the principles of (auditory) filterbanks



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auditory filterbanks

introduction

FT and related transforms are bad models of physiological properties of the human ear:

- frequency resolution (critical bands)
- frequency scale (pitch resolution)
- loudness & masking
- event perception & time integration

⇒ **auditory filterbanks**

not as widely used as one might think because

- 1 computationally inefficient
- 2 analysis only: no invertibility (mostly)
- 3 not proven to be superior

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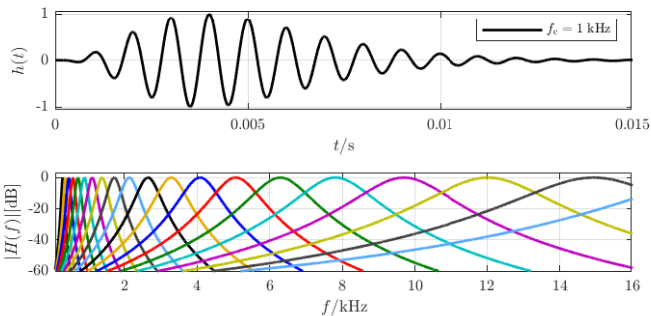
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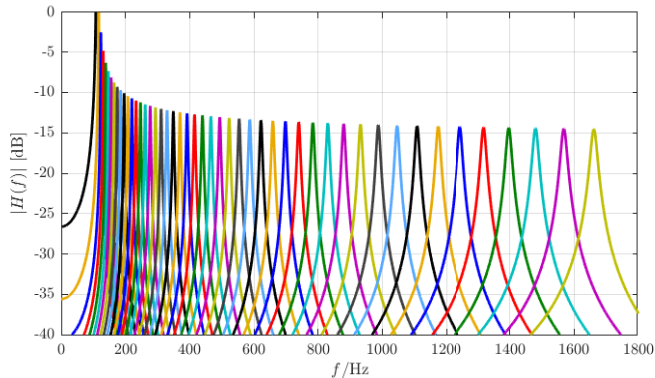
gammatone filterbank

$$h(i) = \frac{a \cdot (i/f_S)^{\mathcal{O}-1} \cdot \cos\left(2\pi \cdot f_c \frac{i}{f_S}\right)}{e^{2\pi i \Delta f / f_S}}$$



auditory filterbanks

gammatone filterbank



summary

lecture content

- **filterbank-based frequency transforms**
 - possibly good model of human physiology
 - high time resolution
 - not invertible and inefficient
 - not proven to be superior

