



Introduction to **Audio Content Analysis**

module 3.3.4: time-frequency representations — filterbanks

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introduction

overview

corresponding textbook section

section 3.3.4

■ 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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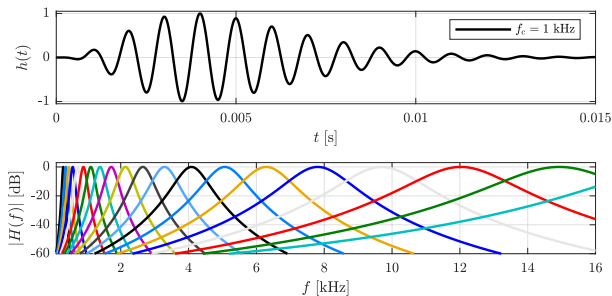
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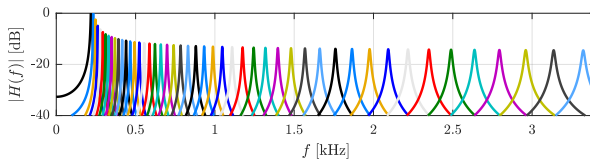
gammatone filterbank

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



other filterbanks

resonance 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

