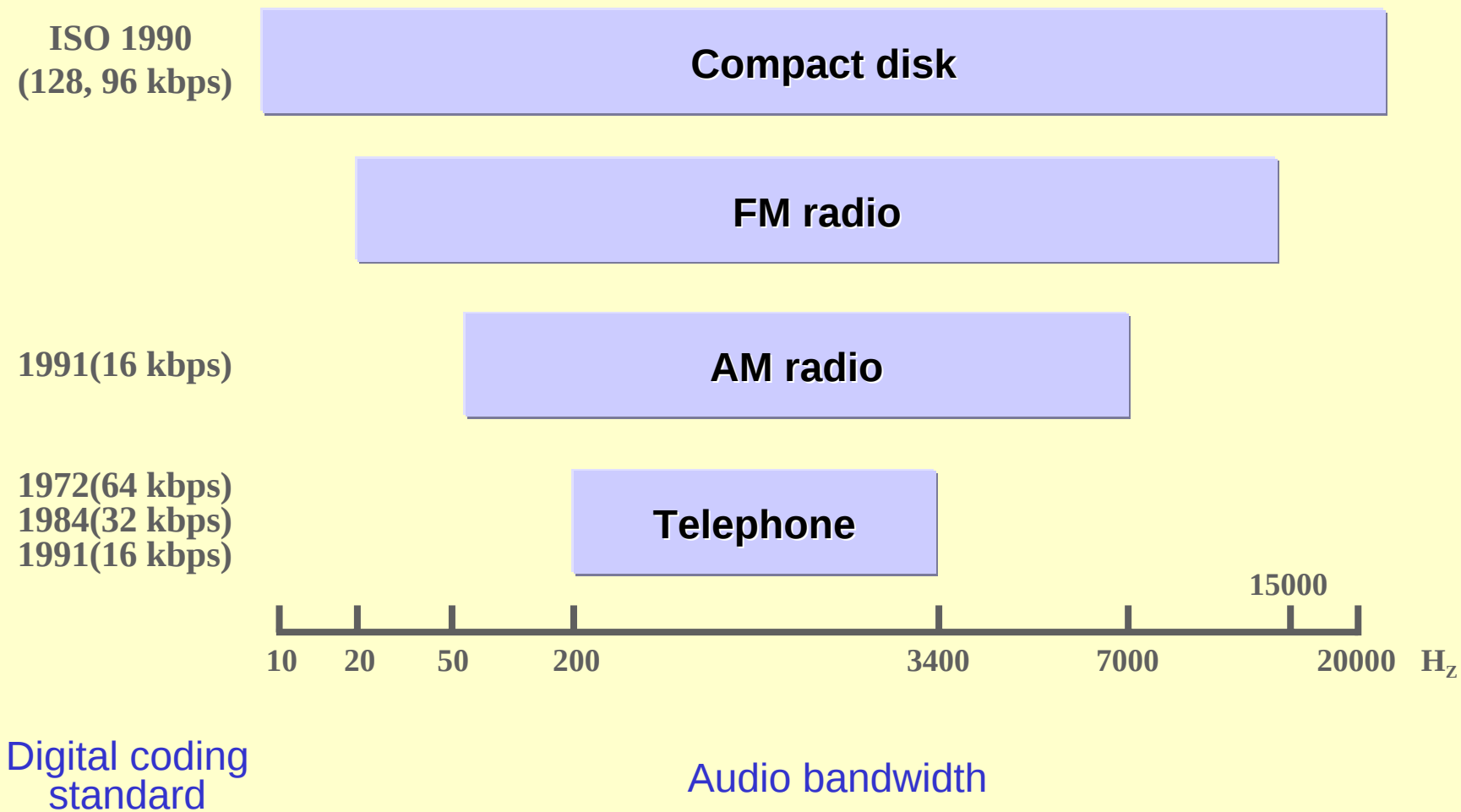


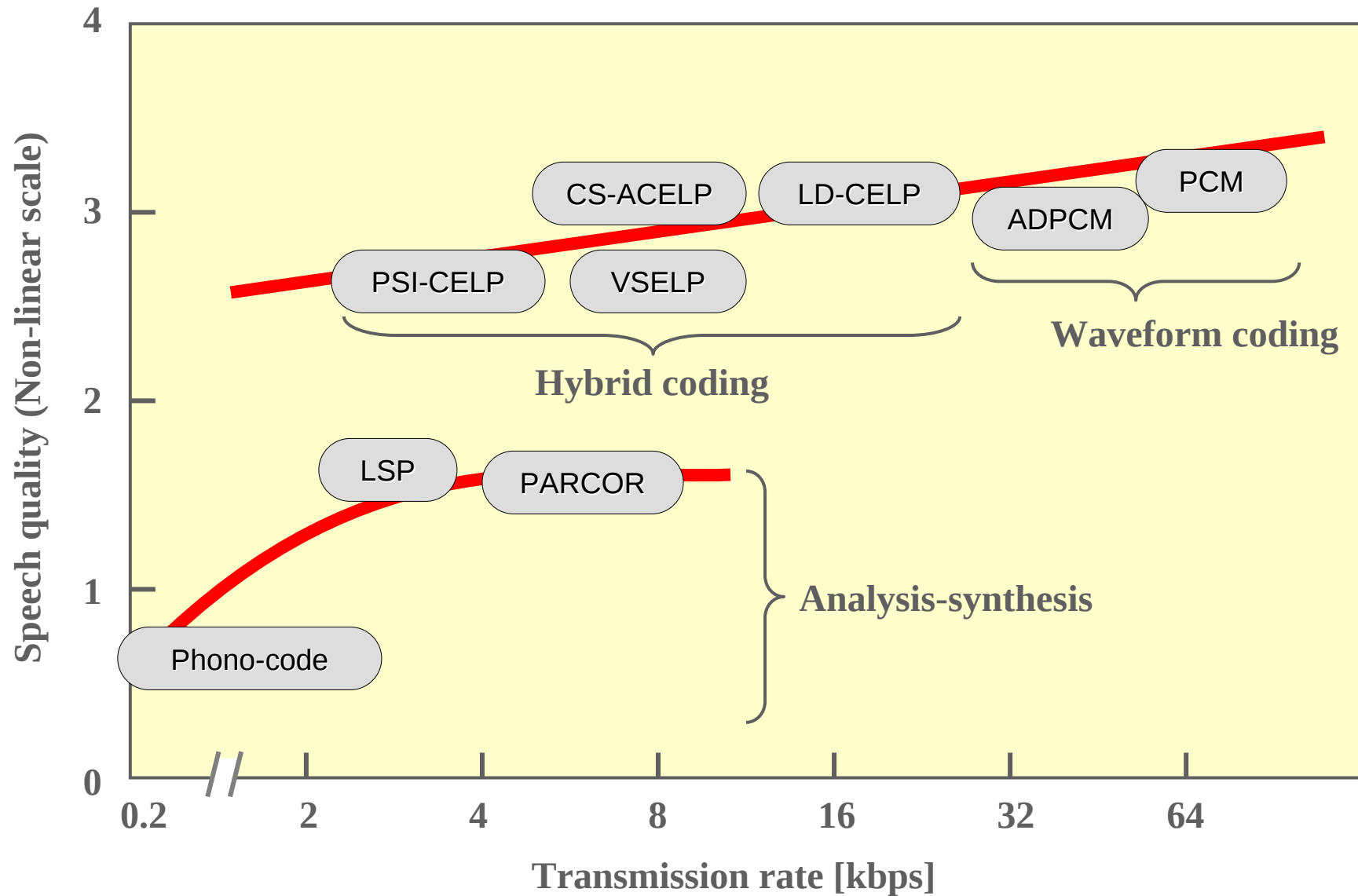
Speech Coding

Sadaoki Furui

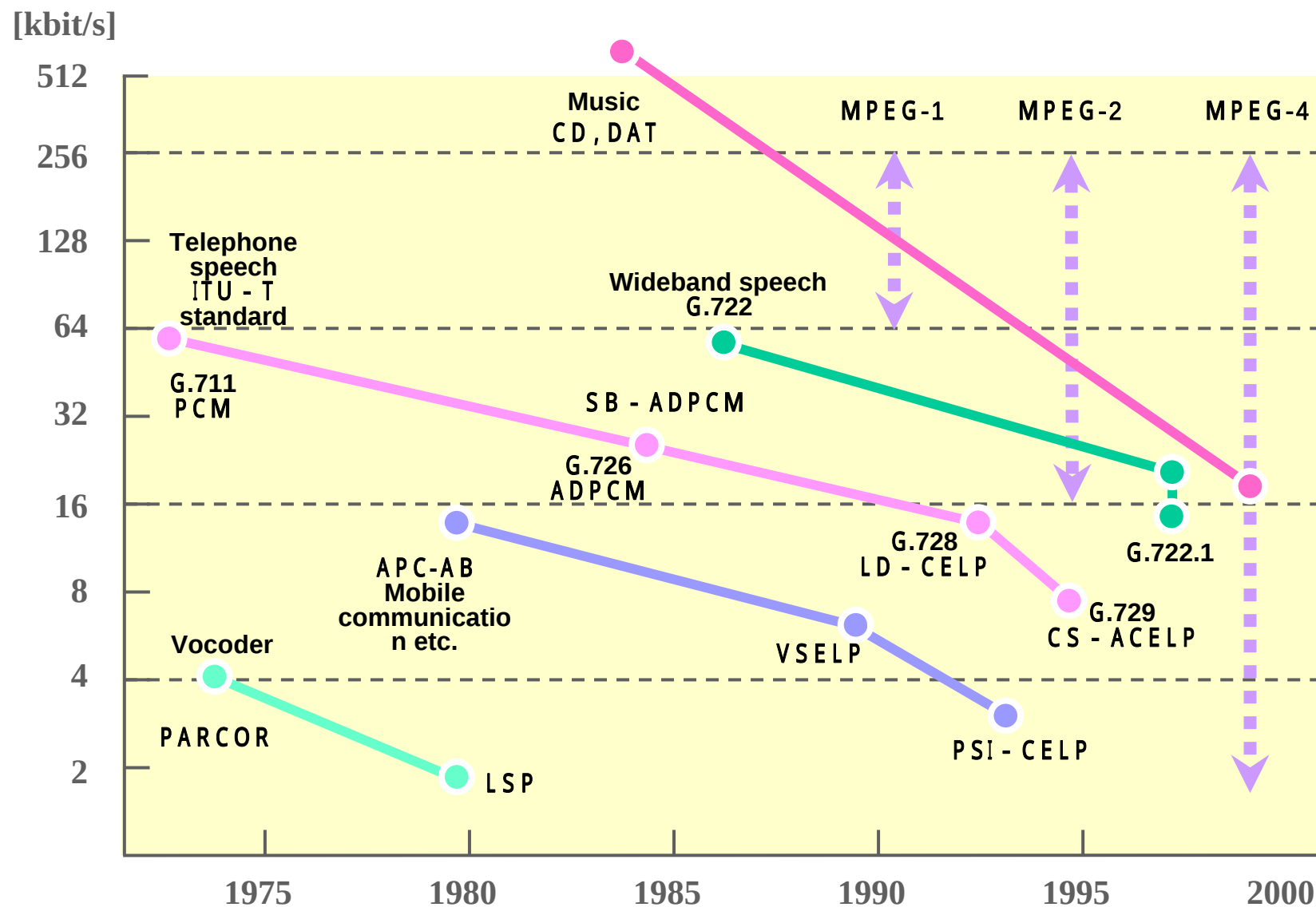
Tokyo Institute of Technology
Department of Computer Science
furui@cs.titech.ac.jp



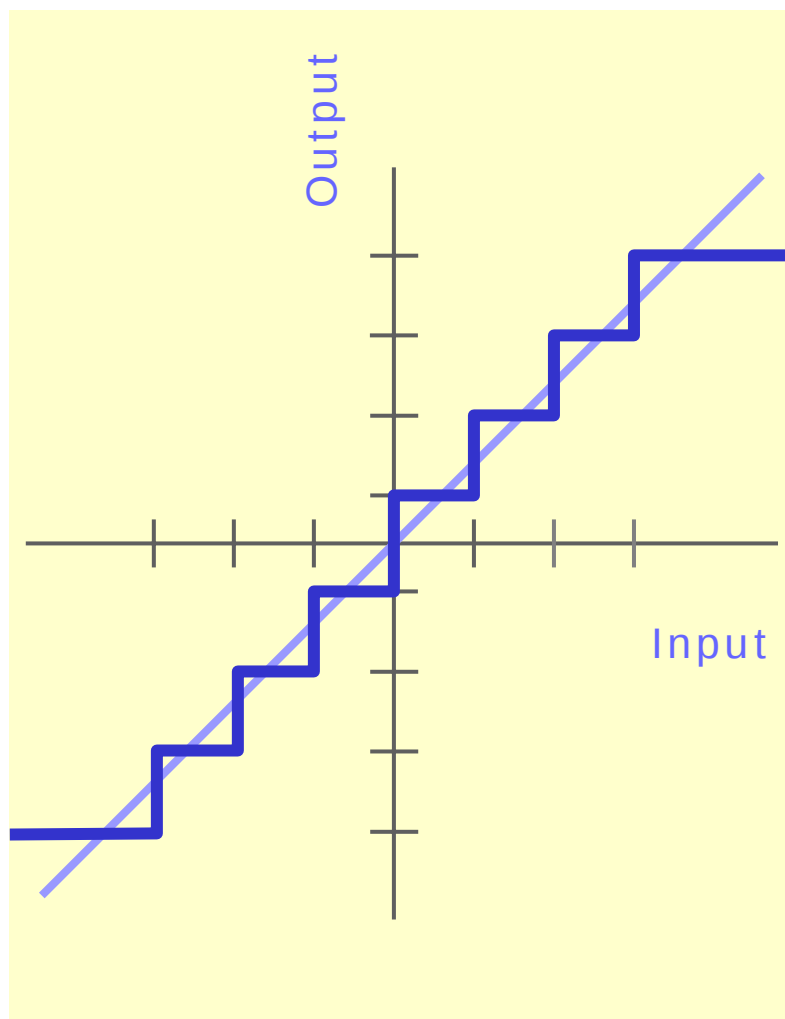
Digital coding standards



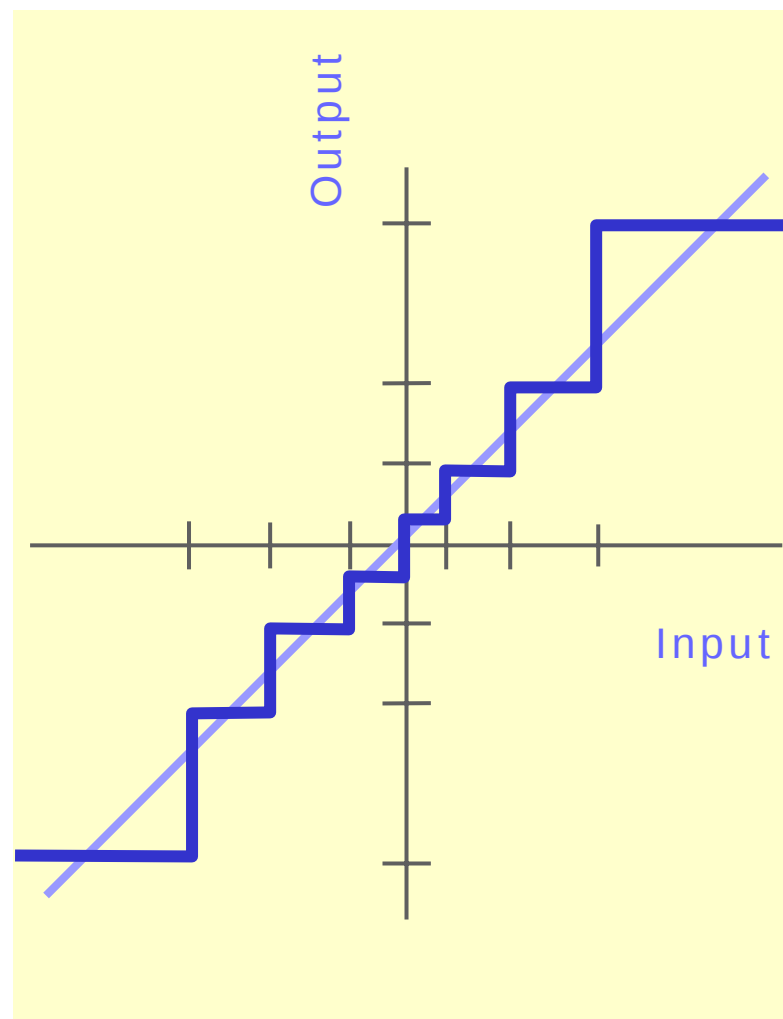
Coded speech quality versus transmission rate



Progress of speech and audio coding

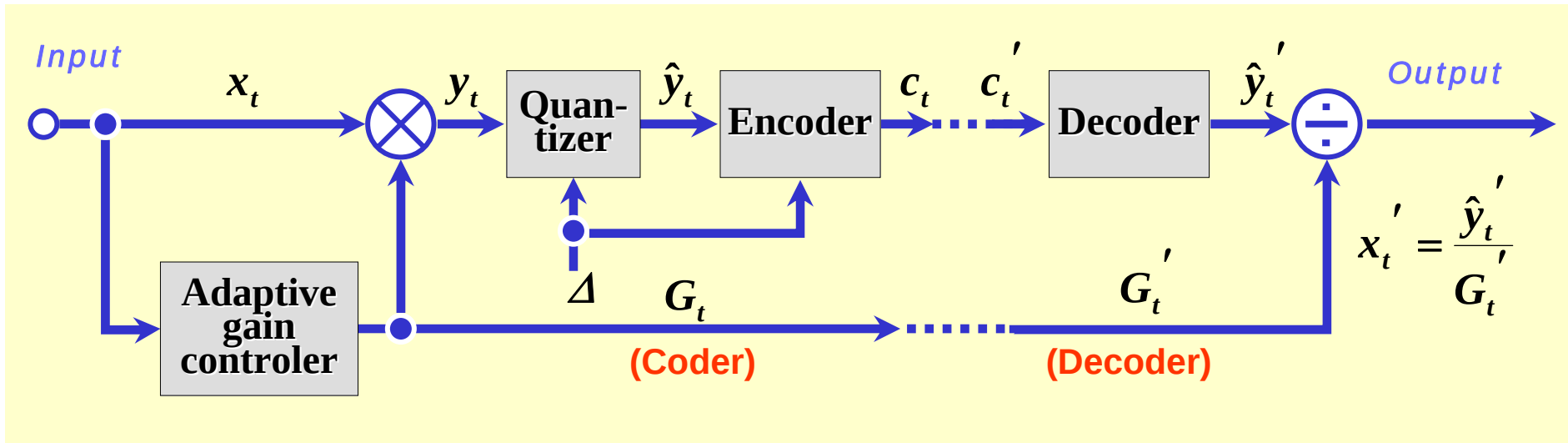


(a) Linear quantization

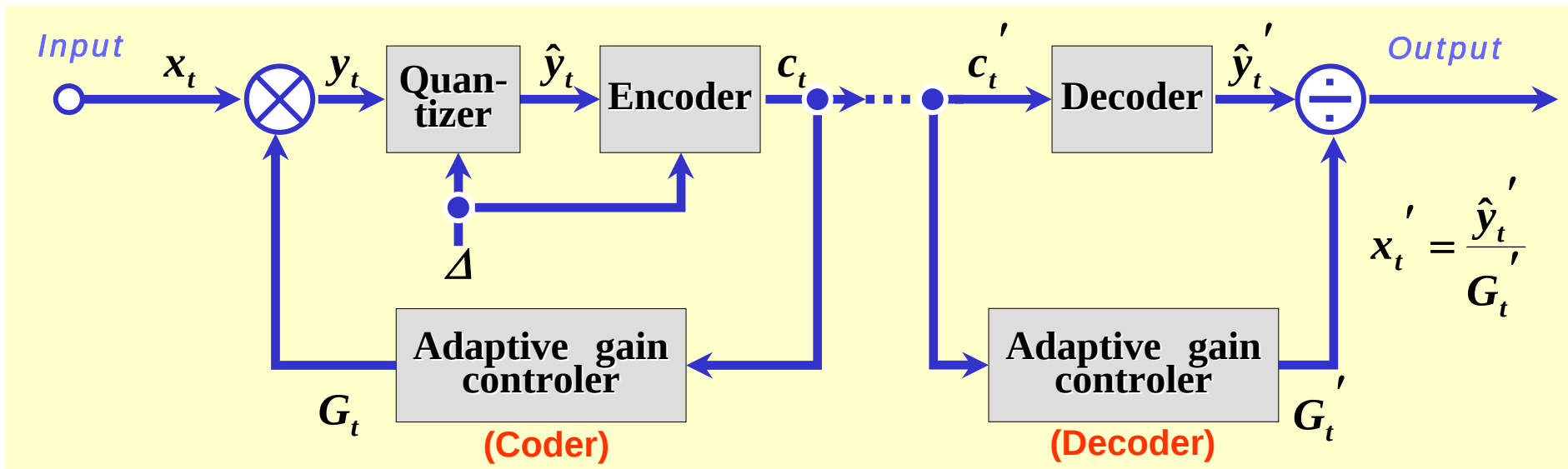


(b) Nonlinear quantization

Input-output characteristics of linear and nonlinear quantization

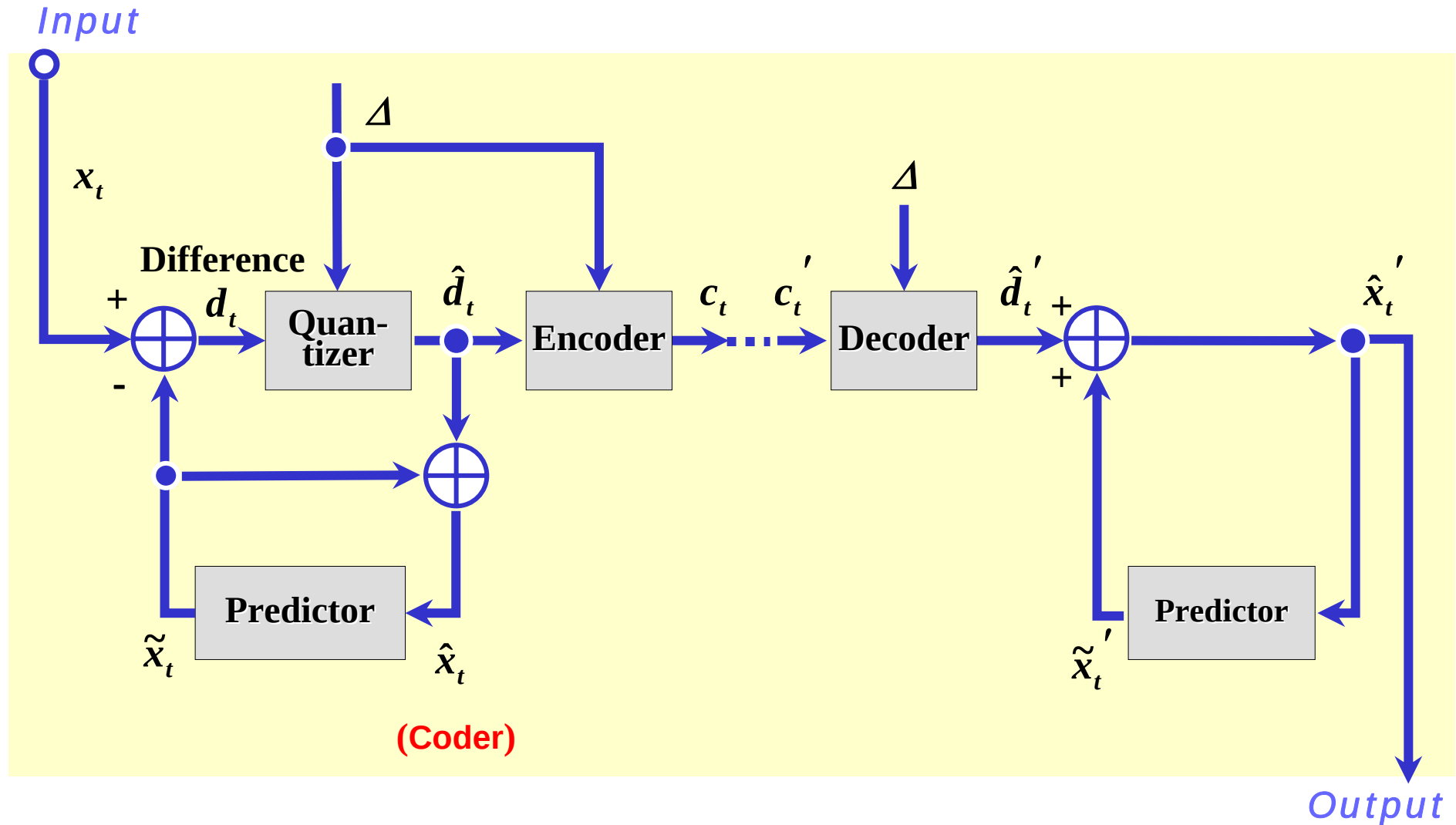


(a) Forward adaptation



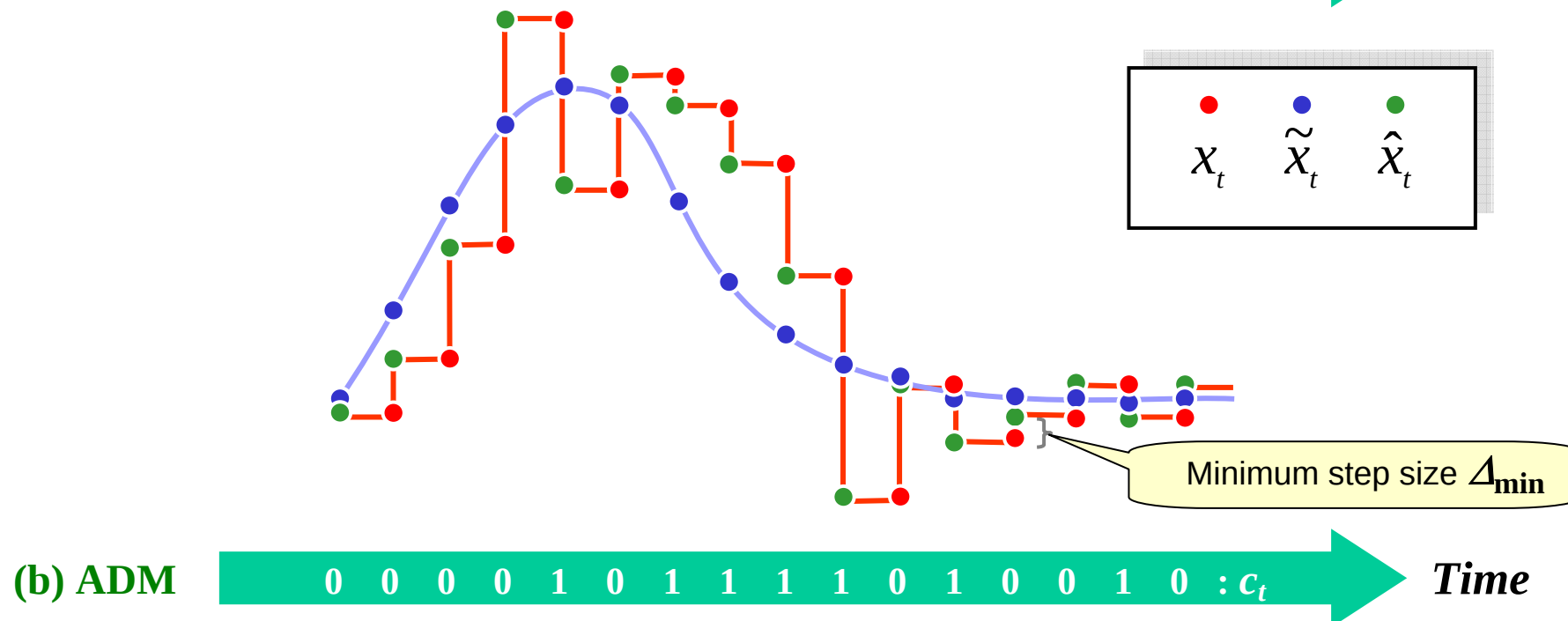
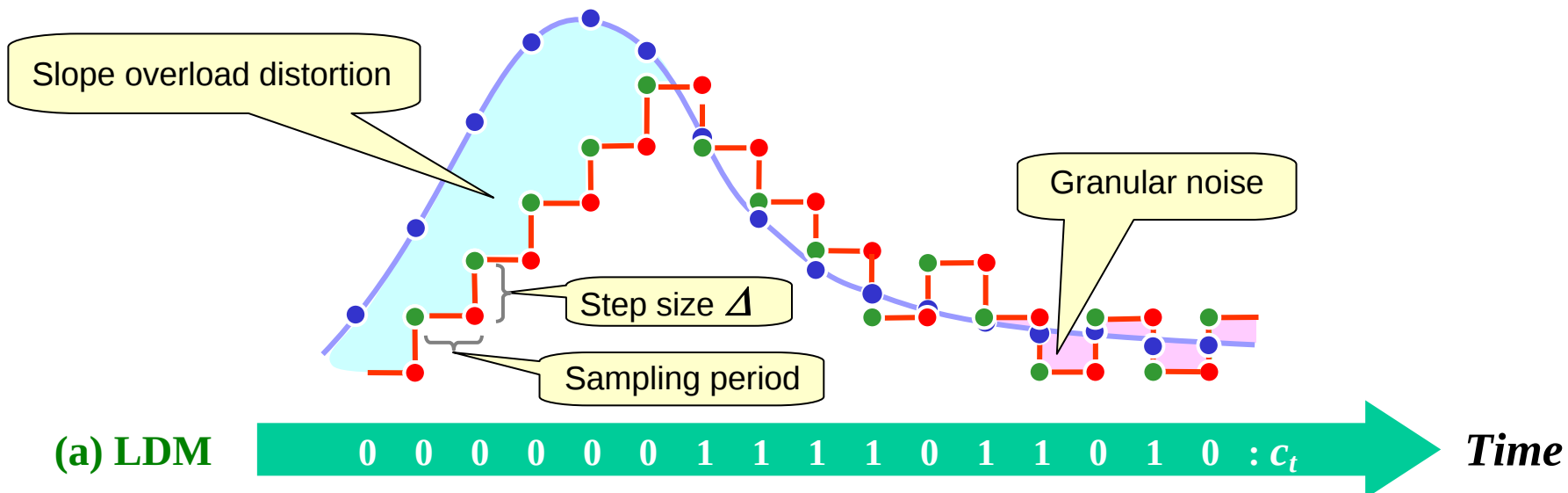
(b) Backward adaptation

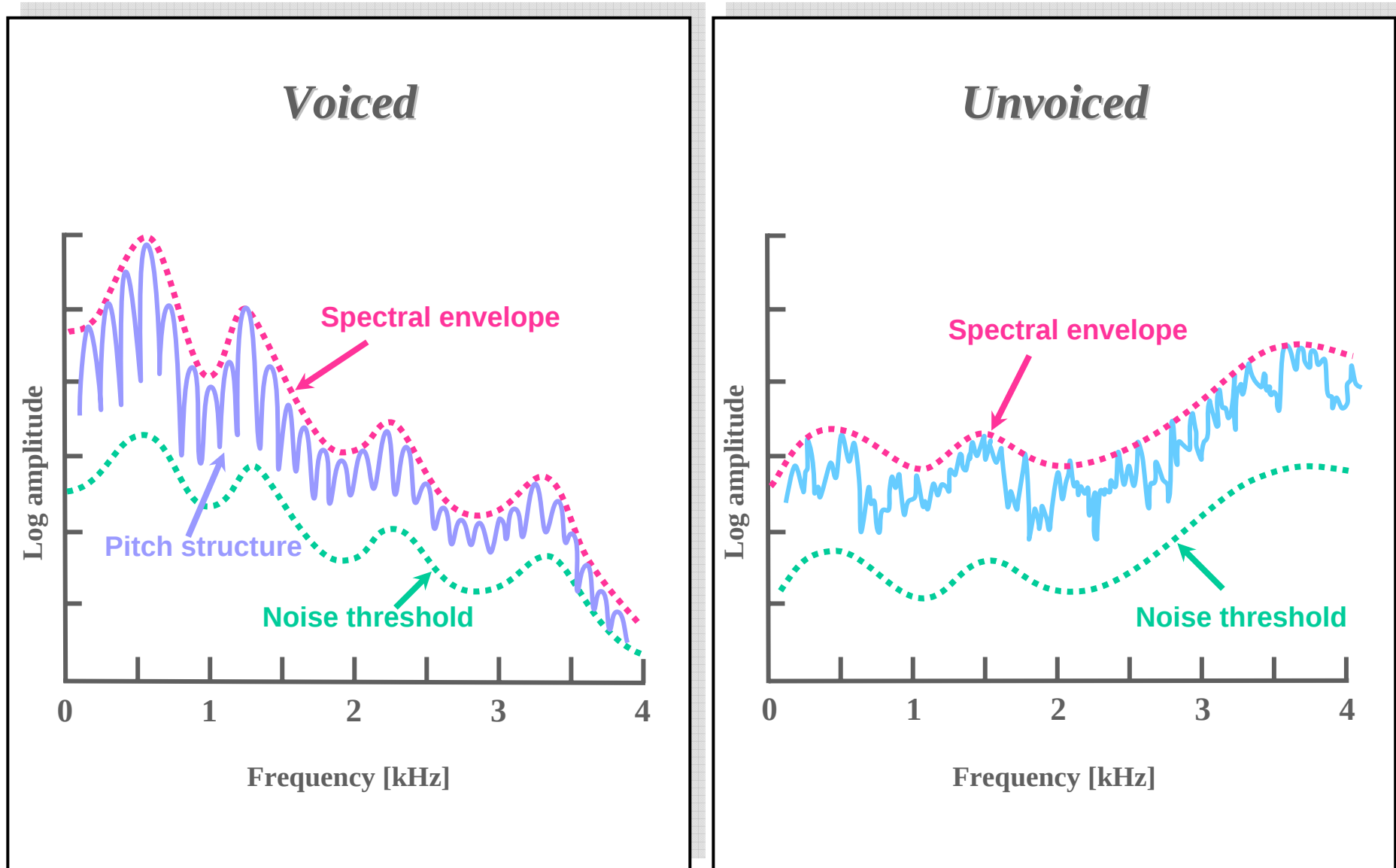
Block diagram representation of adaptive PCM



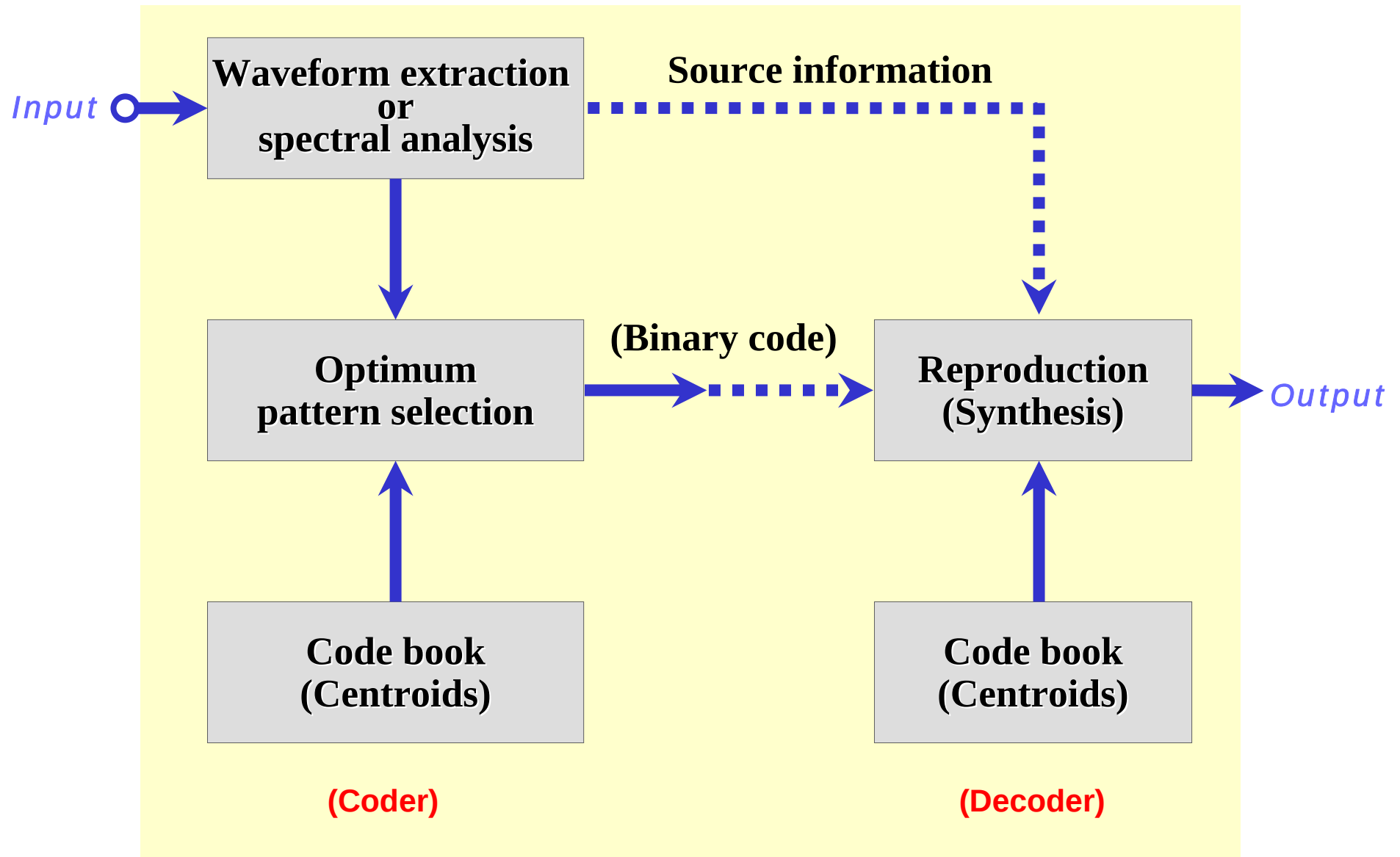
Block diagram of predictive coding

Illustration of delta modulation

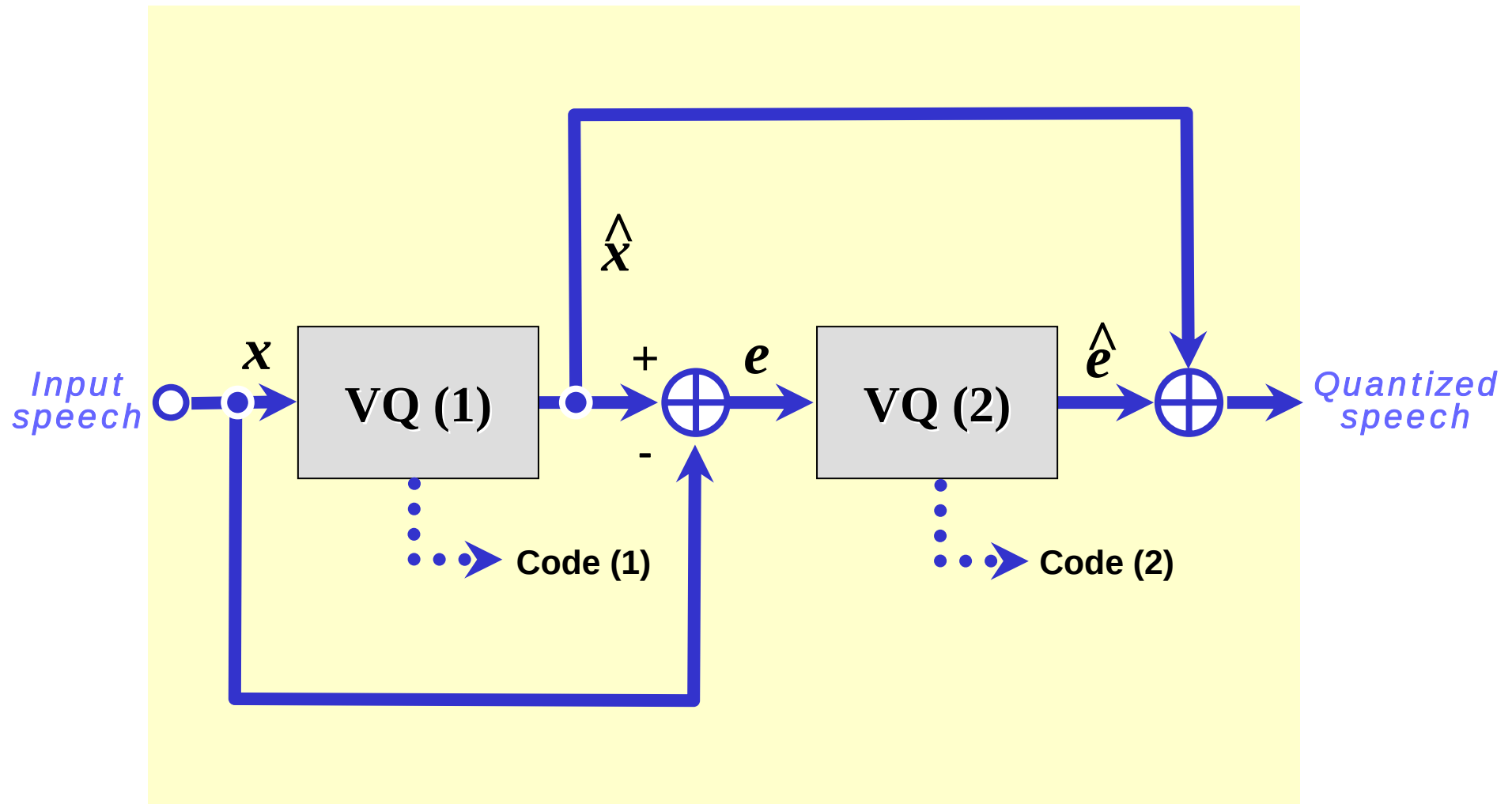




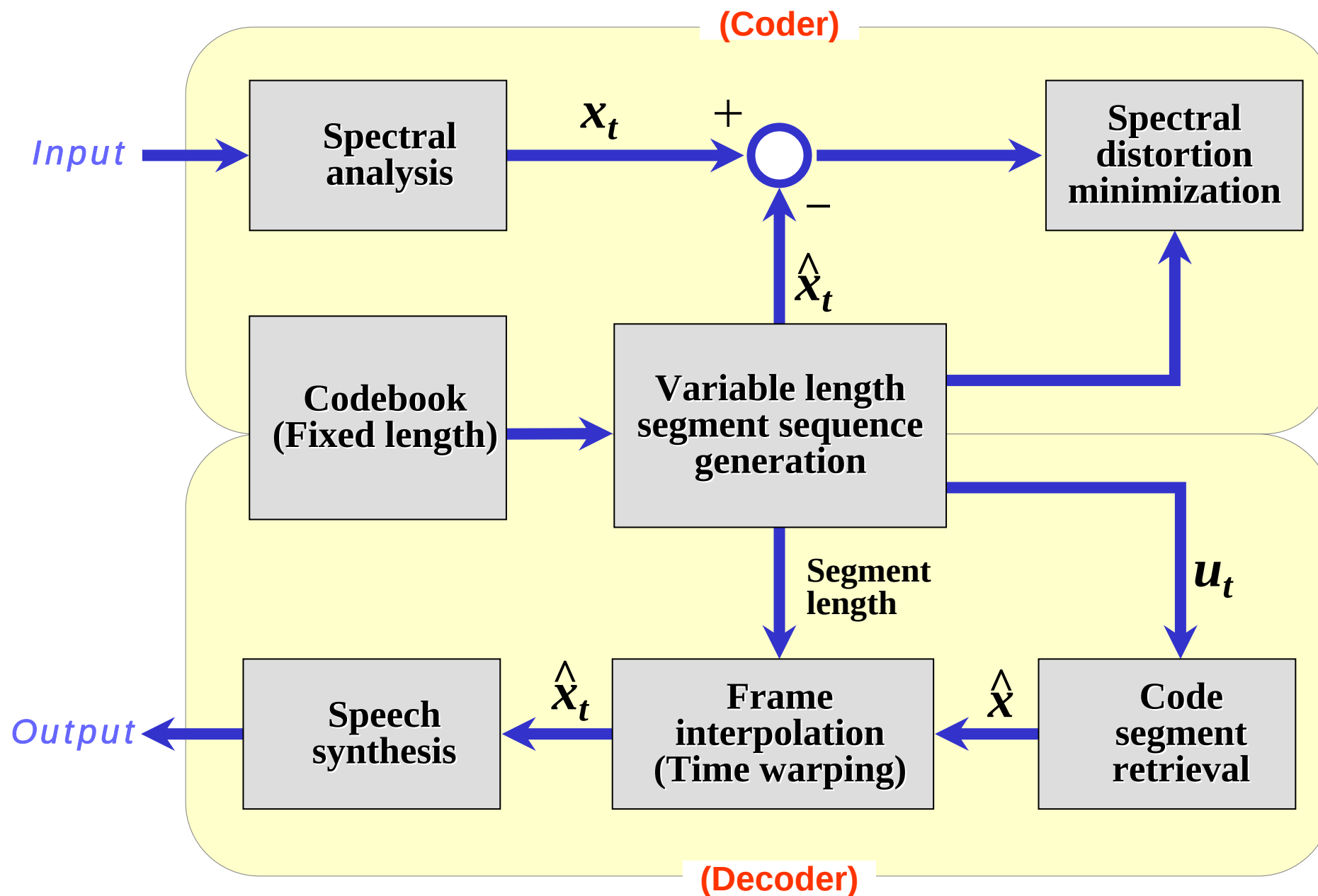
Noise threshold for auditory masking associated with spectral envelope



Block diagram of VQ



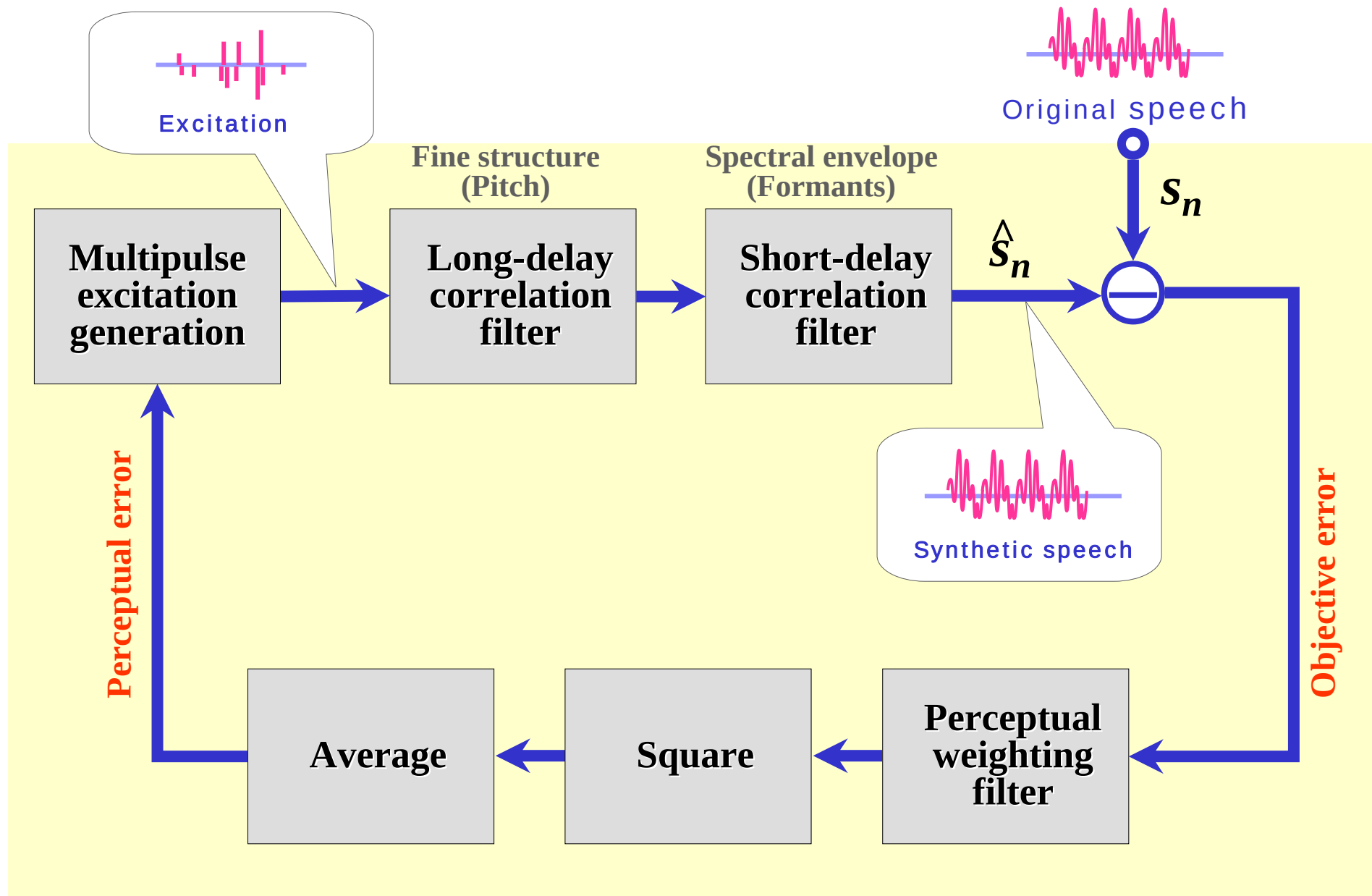
Block diagram of multistage VQ



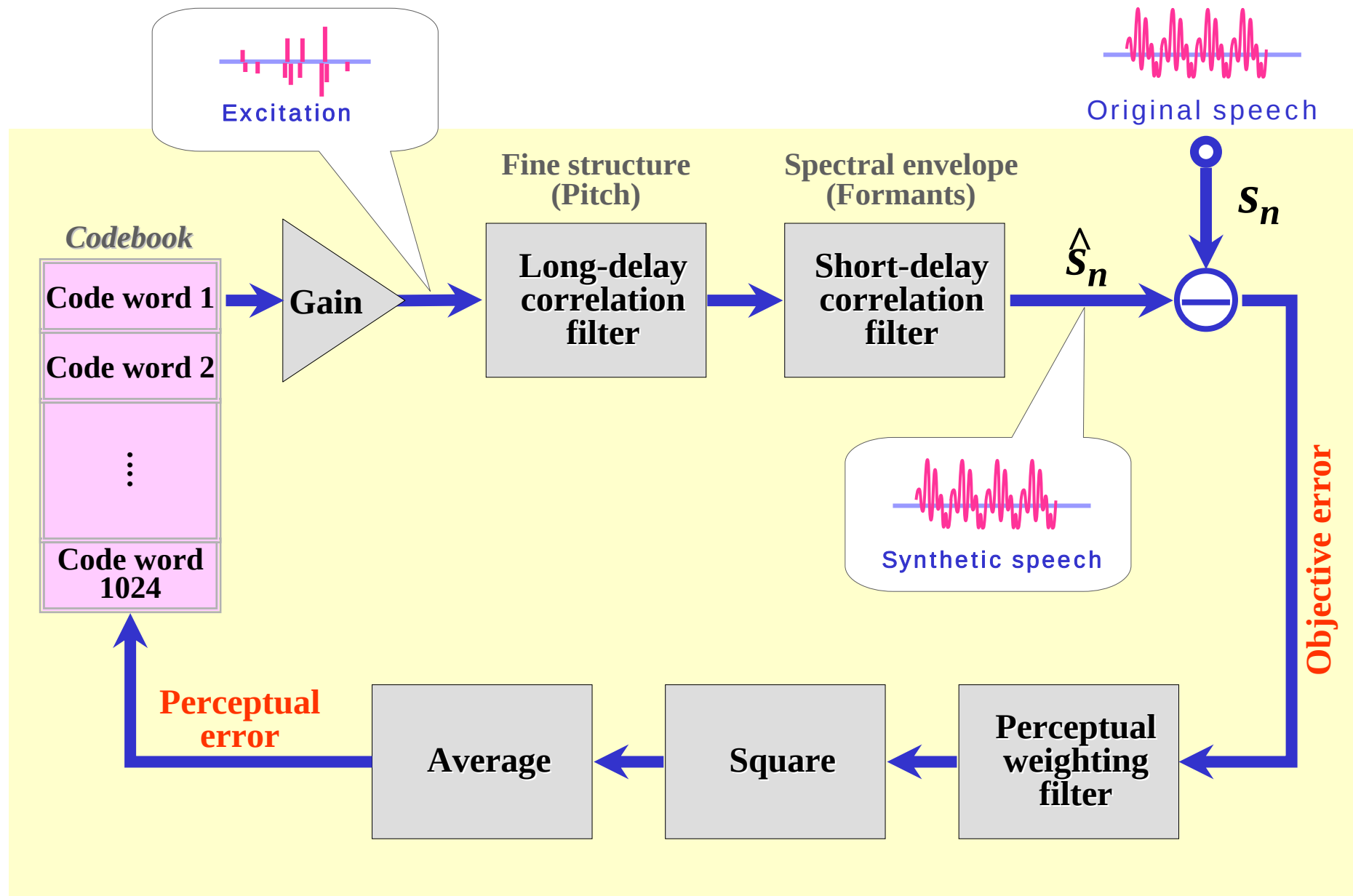
Block diagram of Phono-code method

Phono-code specifications

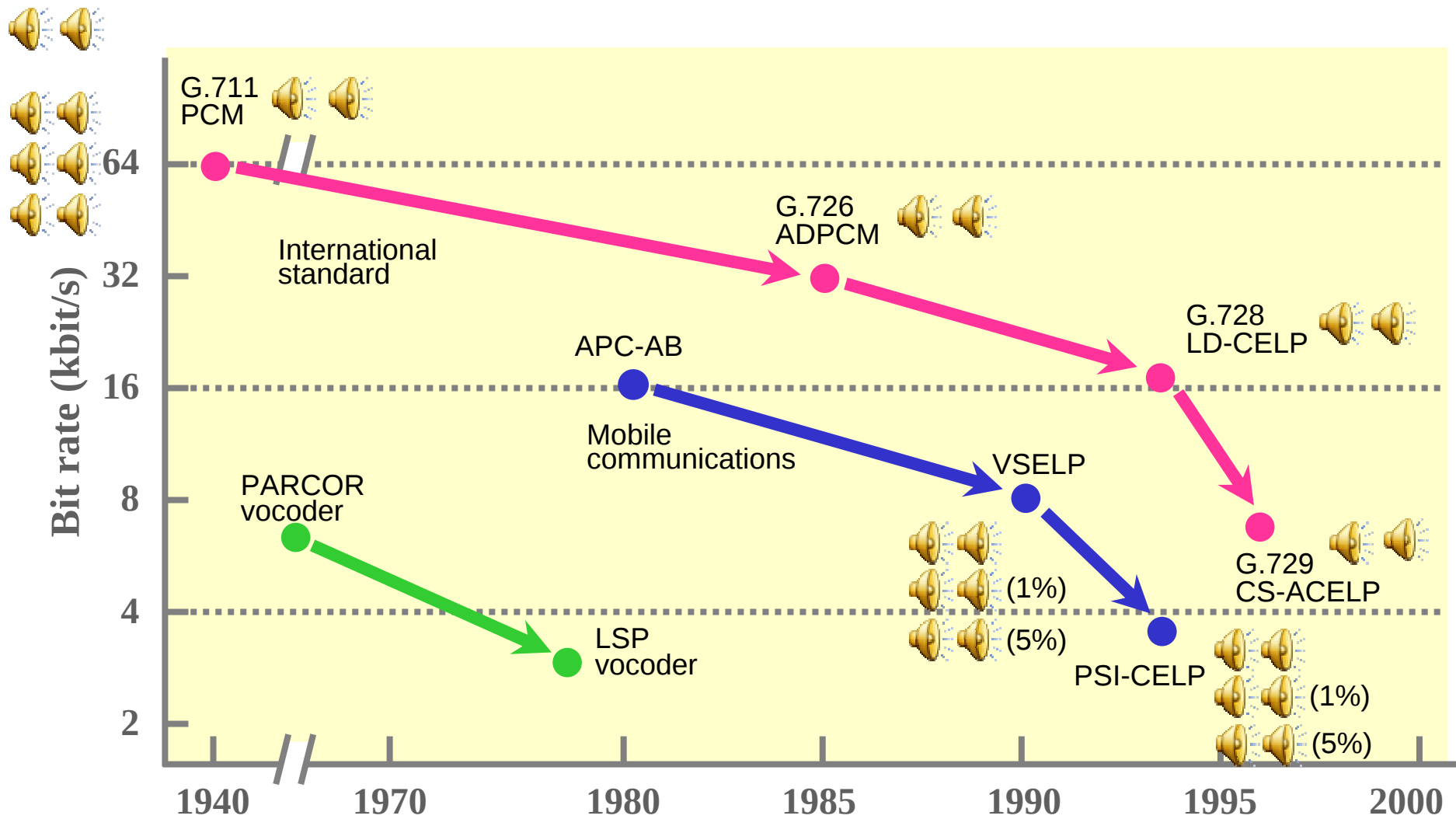
- Segment rate: 12 segments/s
- Phono-code: 10 bits
- Segment length: 5 bits
- Source signal: 4 bits
- Total bit rate: 228 bits/s



Procedure for determining optimum excitation in MPC

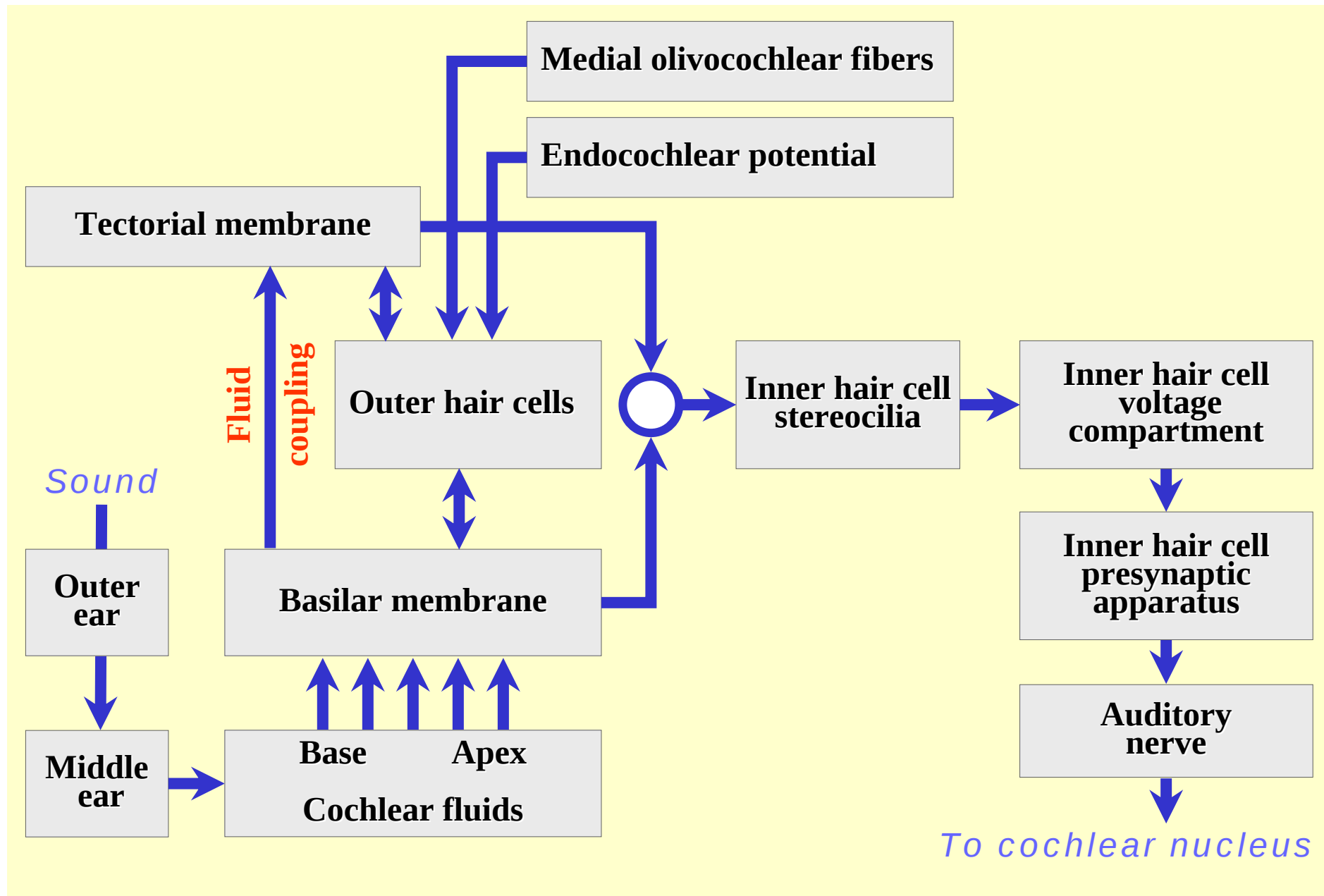


Search procedure for determining best excitation code in CELP

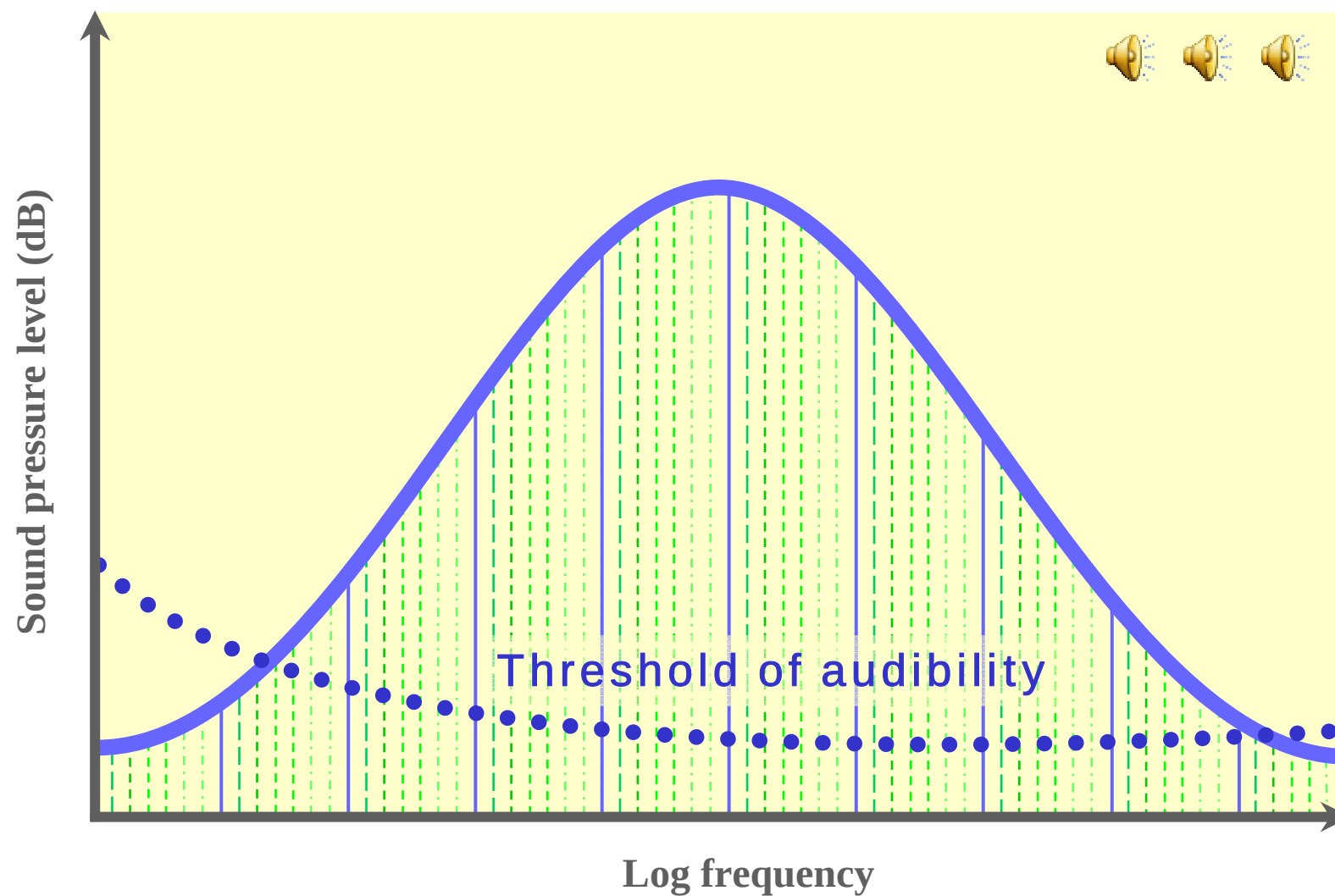


Progress in transmission rate reduction

Conceptual block diagram of the peripheral auditory system

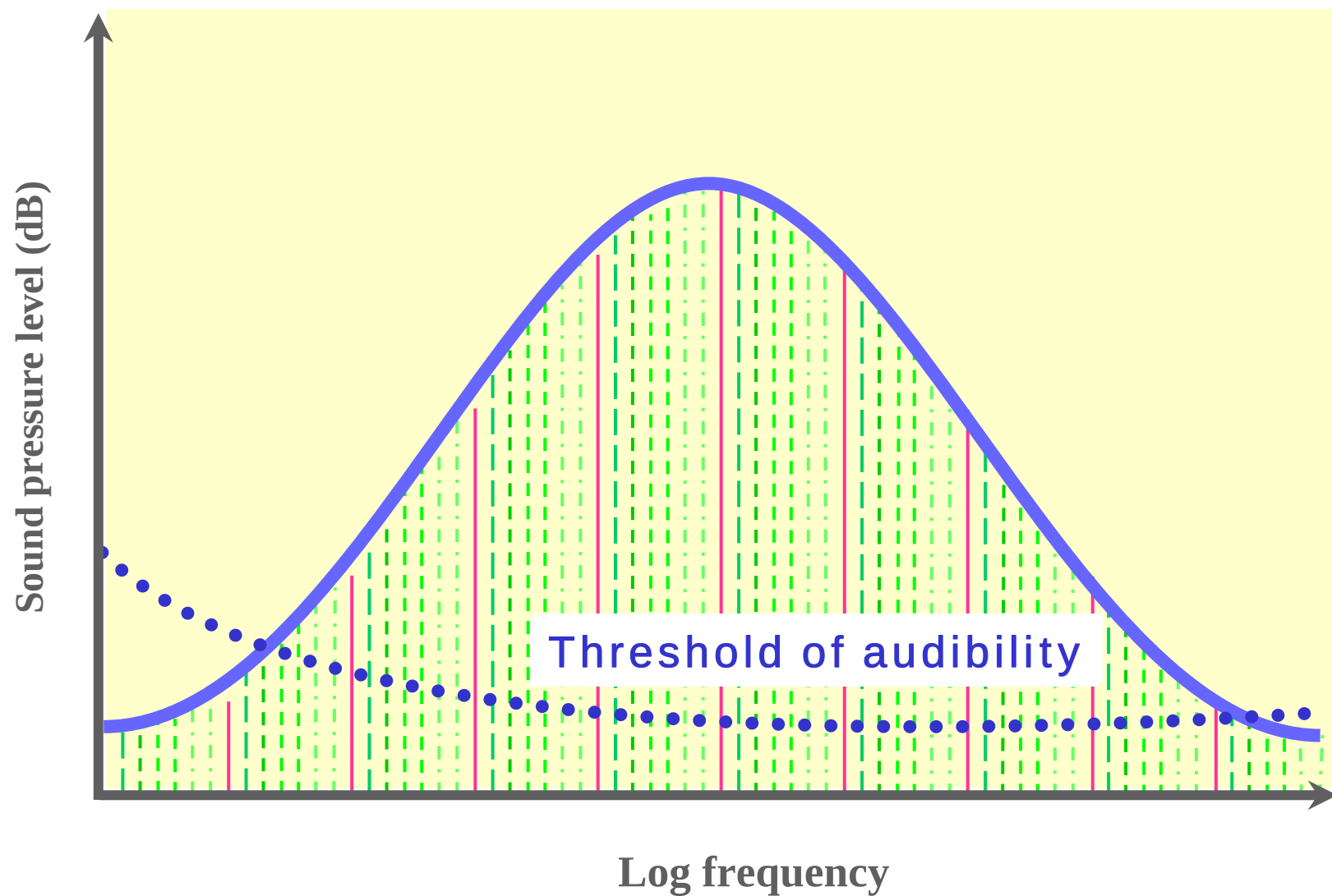


Mechanism of pitch paradox, “endless scale”



Shepard, 1983

Mechanism of pitch paradox, “endless scale”



Shepard, 1983