Conclusion

1. Odd-even parameter interpolation gives better result but increases the packetizing delay by a factor of two.

2. Short-term filter parameters are perceptually more important and should be given highest priority followed by long-term parameters and excitation parameters.

Future Work

1. Simulation for other packet loss probabilities.

2. Reduce the packetizing delay.

3. Priority Audio/Video Coding.

Code-book Index and Gain Packet loss Segmental SNR performance

1. Zero Substitution.

2. Replacement by last frame of last packet.

3. Odd-even parameter interpolation.

sequence	No loss	Method 1	Method 2	Method 3
1	12.601	10.084	8.847	9.4541
2	9.821	8.4387	7.7311	8.031

Long-term Parameters Packet loss Segmental SNR performance

1. Zero Substitution.

2. Pitch replaced by max. occurrence of pitch in last 100 frames.

3. Replacement by last frame of last packet.

4. Odd-even parameter interpolation.

sequence	No loss	Method 1	Method 2	Method 3	Method 4
1	12.601	10.292	10.248	9.349	9.0505
2	9.821	8.6810	8.642	8.359	7.676

Short-term Parameters Packet loss Segmental SNR performance

1. Replacement by last frame of last packet
2. Odd-even parameter interpolation

sequence	No loss	Method 1	Method 2
1	12.601	11.161	12.051
2	9.821	9.010	9.820

Assumptions

1. Network queue server can read the packet header and determine the type of speech packet.

2. Receiver is provided with the missing or lost packet and the correct time position.

3. For initial simulation, we assume that two of the three classes are transmitted with out loss and the third class has nominal packet loss rate of 10%.

Packet Regeneration Methods for CELP coders

1. Replacing all the parameters of the lost packet with the zero.

2. Replacing all parameters of the lost packet with parameters of last frame of previous packet.

3. Odd-even parameter interpolation.

7200bps CELP Coder : Bit Allocation

Parameter	Update Time (Frame)	Bits Allocated	Bit rate bps
LPC filter param.	20msec	40	2000
Pitch M	5msec	7	1400
Pitch Predictor Gain β	5msec	5	1000
Code-book Index	5msec	9	1800
Code-book Gain	5msec	5	1000
			7200

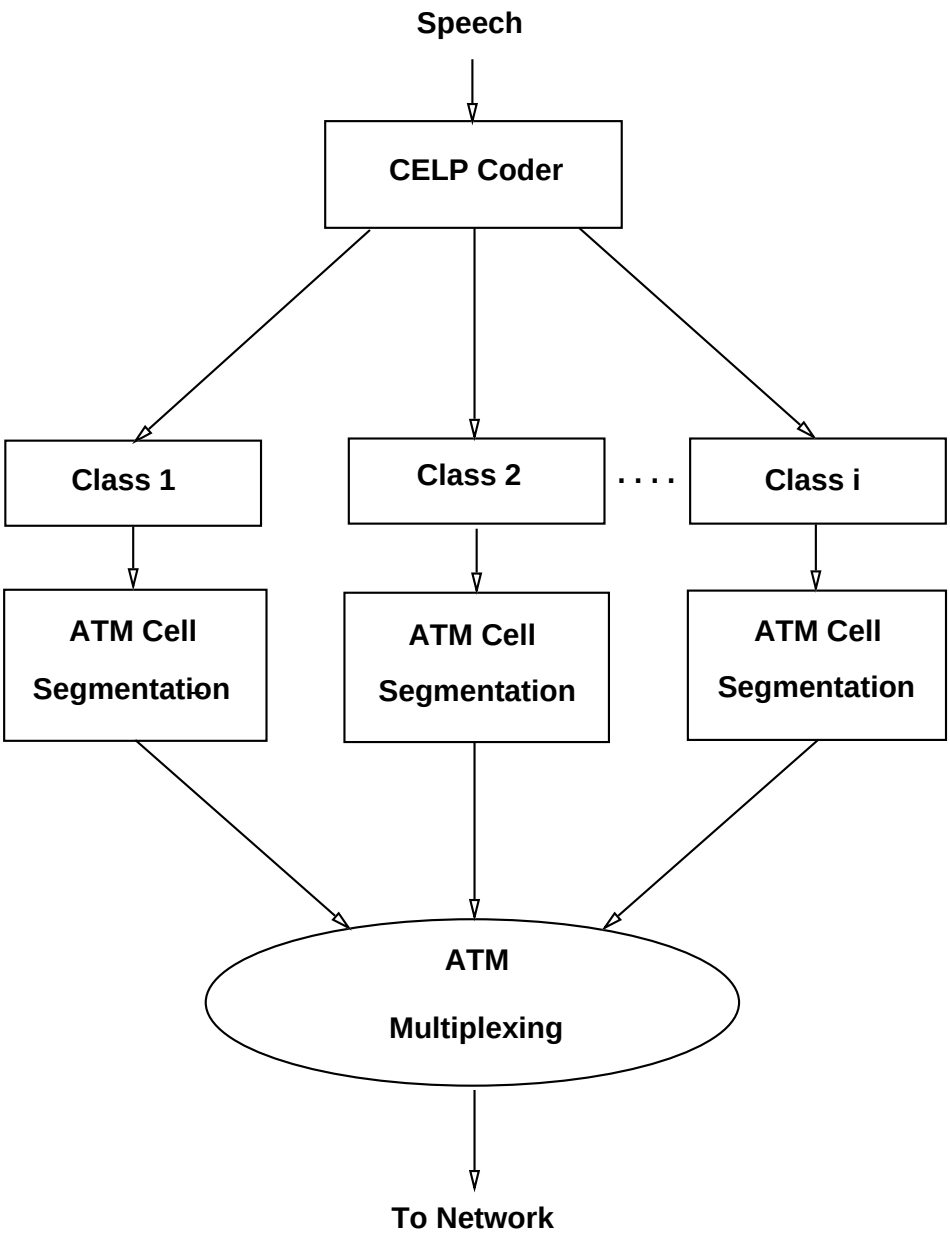
ATM Packet	No. of Frames	
Class 1: Short-term Parameters	9	180msec
Class 2: Long-term Parameters	32	160msec
Class 3: Excitation Parameters	27	135msec

1 ATM Payload = 48 Bytes

Classification of CELP parameters

- For initial simulation, the CELP parameters are divided into three classes.
  Class 1 : Short-term filter parameters
  Class 2 : Long-term filter parameters
  Class 3 : Excitation parameters

- Each classes were given different priority according to their perceptual importance.


Speech
CELP Coder
Class 1
Class 2
. . . .
Class i
ATM Cell Segmentation
ATM Cell Segmentation
ATM Cell Segmentation
ATM Multiplexing
To Network

Priority CELP Coding

- Inherent structure of speech signals and the way in which they are perceived allows for some loss of information with out significant quality impairment.

- The quality of received speech can be maintained by classifying speech coder parameter and coding them in a way that will ensure ease of lost packet generation at the receiver.

- By assigning delivery priority to each class, overload control in the network at any point can be achieved by discarding the speech ATM cell according to the delivery priority.

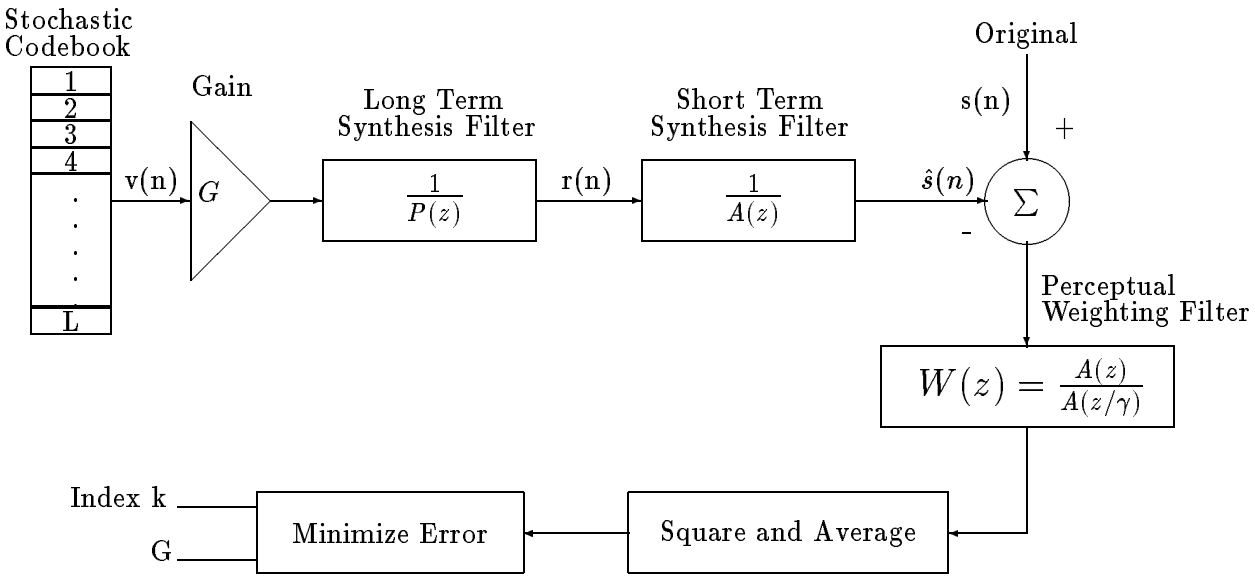
Parameters of CELP

1. Short-term Synthesis Parameters

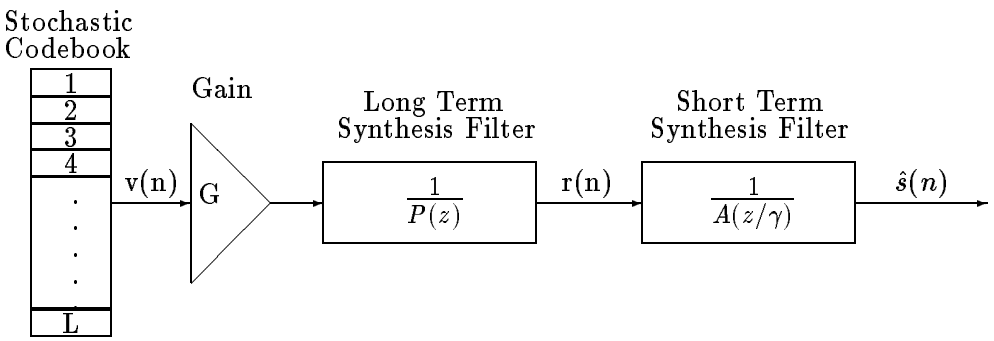
2. Long-term Synthesis Parameters

3. Excitation Code book Parameters

CELP Encoder



CELP Decoder



Inverse LT filter $P(z) = 1 - \beta z^{-M}$

Inverse ST filter $A(z) = 1 - \sum_{i=1}^{p} a_i z^{-i}$

CELP
(Code Excited Linear Prediction)
Coder

1. Low Bit Rate Coding (4.8-8kbps)

2. Frame Oriented Technique

3. Based on

    - Analysis-by-synthesis Algorithm
    - Perceptually Weighted VQ
    - Linear Prediction

CELP Coding in ATM Networks

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