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Spatial moving sound source with headphone

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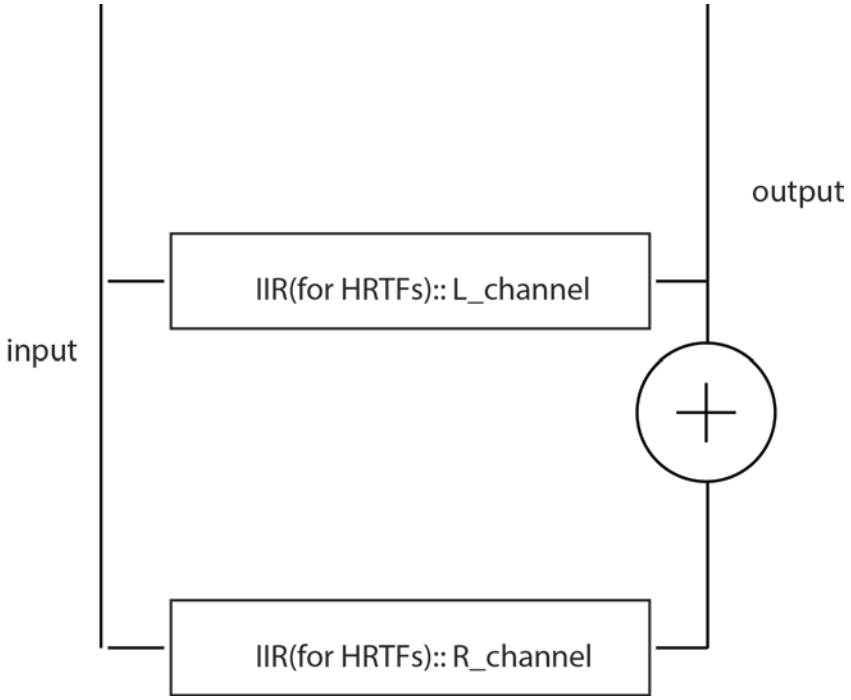
Introduction:

The 3D spatial sound with headphone, it offers psychological information relate the location to the audient psychological information. And also, this sort of spatial sound has been widely used in the game and film industries. however, once we watch movie or play game with headphone, it is easy to find the difference, the film is more fantasy and realistic than the game, especially the sound track of the movie makes the audience feel himself in the film, the game is hardly to catch movie. The reason for that is the film use more advanced technology to collect and develop sound effect or track.

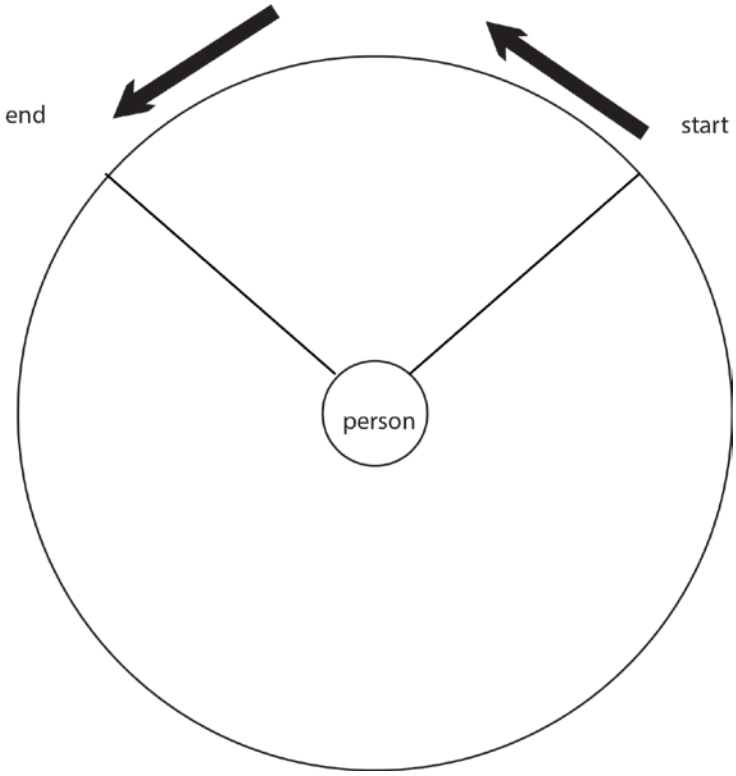
Fortunately, because of the gamers, we can have more advanced headphone today. If we notice the speak market share, we will find the headphones' brands are more concerning about their headphone for the game. In order to match the gamers' desires, the headphone is designed for precise location in tiny of period. Due to this kind of headphone, it is good opportunity to use that to create the music or sound like background music in the film. Therefore, I try to make a filter to simulate the moving sound source in the environment.

This is my filter design draft, we can see the signal has been divide into two channels and beginning of the processing, and then , the IIR filter use the signal process relate to the specific angle to obtain the result, at the end of the process, the function combine both channel together.



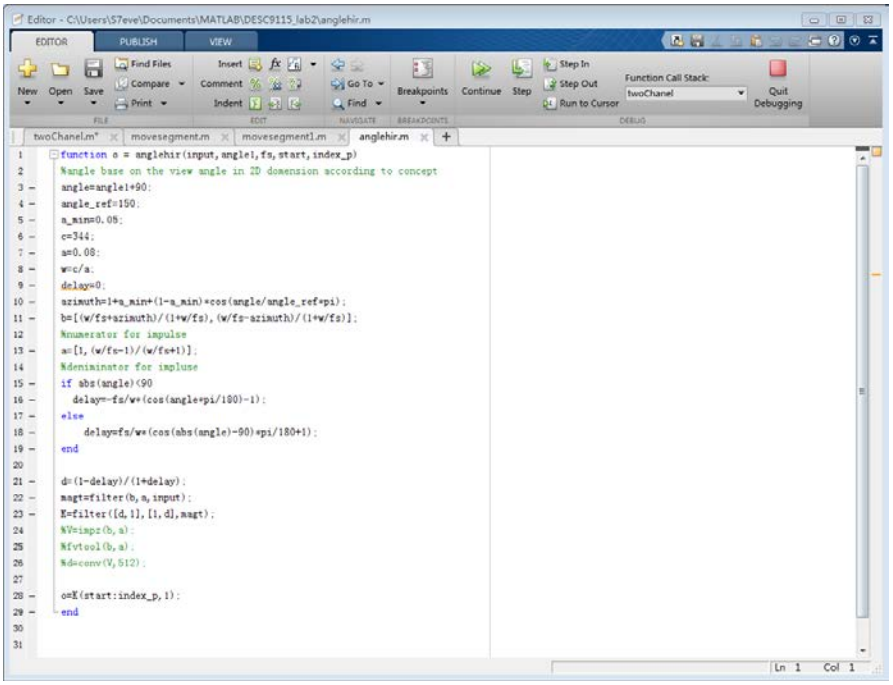
Generally Speaking, the filter focuses on taking advantage of the 3D spatial sound, but I develop a function in order to specify the track of sound source follow.

Picture shows how the filter works, the sensitive in function called twochanel is segments between the end and start point, usually the big number is easy to get smooth sound(such as 20);

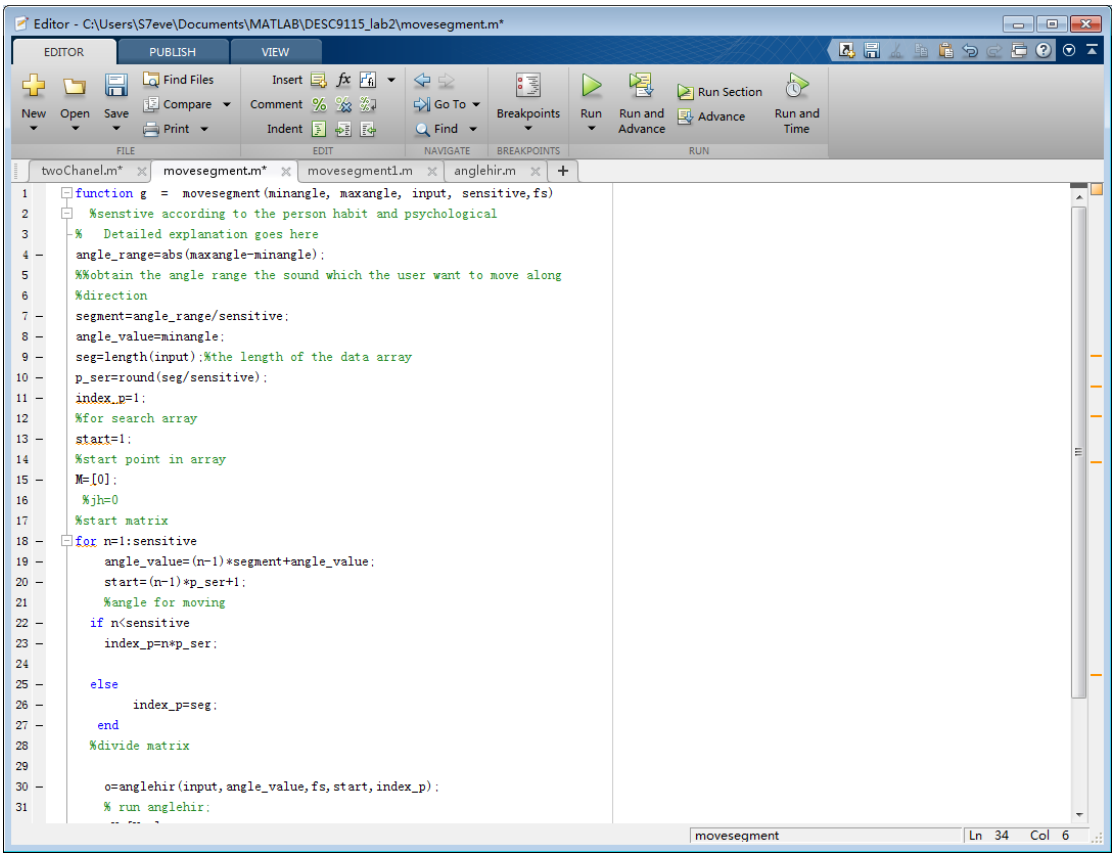


Function:

The filter is consisted by four functions, anglehir, movesegment, movesegment1 and twochanel, anglehir function is used to obtain the matrix on the specific angle;

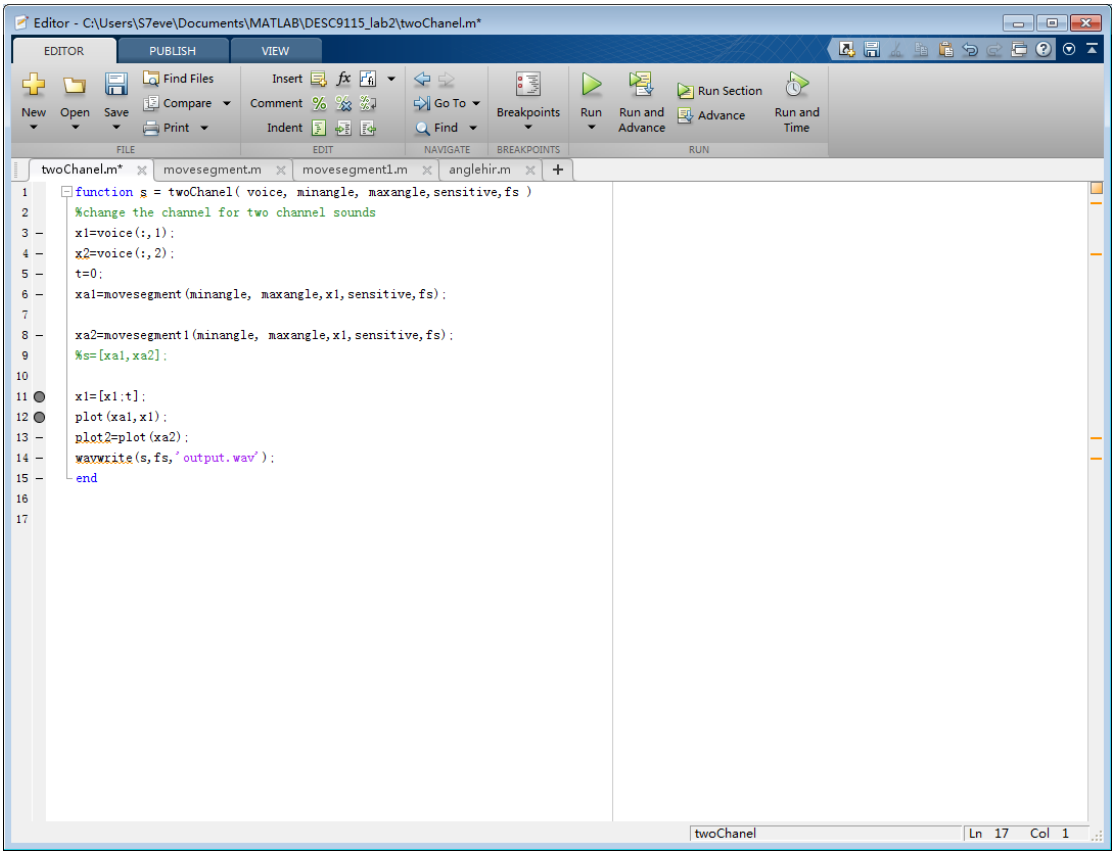


movesegment works for controlling the sound source movement for one channel;



movesegment1 is similar to movesegment, but work for other channel, twochanel function is used to discrete two channel matrix and output value

The function called twochanel is the API function, it offer the user several arguments in order to user customize the sound.



voice: it is work for input data;
minangle: input the initial angle(relate to head) which you want to put sound source on
maxangle: angle of the end position of the sound source.
sensitive: relate to the density of sound on different angle.

Further analysis:
The filter has already worked in Matlab, also can simulate the movement of sound source. However, the sound lacks some reverberations and multiple movement(such as up to down) function. In the DAFX, it introduce the torso and shoulder is important factor that human realize the position of sound, I may use

$$\gamma sh=1.2*（180^\circ-azimuth）/180^\circ(1-0.000004(\Phi-80)*180^\circ/(180^\circ+azimuth))$$

Obtains the delay in time domain, and then, using the Fourier transform to calculator the reverberation value in frequency domain,

And also, we have to notice the Left and Right ears help human to locate the sound source, in another words, if we can deeply understand the delay difference and sensitive difference between two ears, we can simulate more realistic and reasonable sound

Bibliography

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