reverb in long halls / corridors

newtopic   postreply   **Page 1 of 1** [9 Posts]

---

vfunc@talktalk.net
science forum beginner

Joined: 26 Apr 2006
Posts: 4

Posted: Fri May 05, 2006 6:50 am   Post subject: 📰 reverb in long halls / corridors   quote

I am I right in thinking that sound is like pushed in a long hall / corridor ? The reverberations back and forth form lots of wave fronts ? How much sound can travel around a corner of a corridor ? How can this spread of the original sound be calculated ?

Back to top

Savant
science forum beginner

Joined: 07 Jun 2005
Posts: 13

Posted: Fri May 05, 2006 10:54 pm   Post subject: 📰 Re: reverb in long halls / corridors   quote

A good choice for prediction is the Fitzroy equation when you're talking about long & narrow. There has also been some discussion in this forum on the Arau-Puchades (I probably butchered the spelling on that - my apologies if I did!) equation, though I've never used it.

Regards,

Savant

vfunc@talktalk.net wrote:

> **Quote:**
> I am I right in thinking that sound is like pushed in a long hall / corridor ? The reverberations back and forth form lots of wave fronts
> ? How much sound can travel around a corner of a corridor ?
> How can this spread of the original sound be calculated ?

Back to top

---

bert stoltenborg
science forum addict

Joined: 16 May 2005
Posts: 52

Posted: Fri May 05, 2006 11:03 pm   Post subject: 📰 Re: reverb in long halls / corridors   quote

Eric likes the Arau approach, AFAIK, Jeff.

The question is a bit unclear.
It depends on the absrption in the corridor, the dimensions, it's frequency dependent as you have a Schroeder frequency etc. You have to give more data.
And even then rooms with strange shapes are difficult to predict 🙂

Back to top

Chris Whealy
science forum addict

Joined: 05 May 2005
Posts: 54

Posted: Mon May 08, 2006 10:11 am   Post subject: Re: reverb in long halls / corridors

Savant wrote:

> **Quote:**
>
> A good choice for prediction is the Fitzroy equation when you're talking about long & narrow.

The Fitzroy equation accounts for what is known as "on-axis absorption".
In other words, Fitzroy assumed that a room's absorption would not be evenly distributed on the walls, floor and ceiling (as Sabine originally did). So, using his equation you can derive an X, Y and Z reverberation time for each of the three axes in a room. This is useful in two situations (that I can think of off the top of my head):

1) For rooms where the dimensions are similar, Fitzroy's equation is able to predict flutter echo (one reverb time will be significantly longer that the other two).
2) For understanding the reverberation in room where one dimension is significantly larger than the other two. E.G. A corridor.

London Underground has this problem where the Tube stations are the length of a train, but only about 8m wide/high. There are now two distinct reverberation times - one for the two short dimensions, and another much longer time for the long axis. This causes some nasty problems with speech intelligibility during PA announcements.

The same principles will exist in a corridor, though on a smaller scale.

Reinhard Neubauer has modified Fitzroy's equation and introduced another term to account for what he describes as the "almost 2 dimensional sound
field".

> **Quote:**
>
> There has also been some discussion in
> this forum on the Arau-Puchades (I probably butchered the spelling on that - my apologies if I did!) equation, though I've never used it.

This is the formula was developed by the Spanish acoustician Higini Arau-Puchades. He has taken the same approach as Fitzroy, in that he accounts for unequal absorbency in the X, Y and Z planes, but his calculation uses a different approach.

My Control Room Calculator spreadsheet uses all the above formulae for calculating the RT60 of a room.

You can down load this from my (temporary) website at
http://www.bobgolds.com/whealy.com/acoustics/ControlRoom.html

Regards

Chris W

--
The voice of ignorance speaks loud and long,
But the words of the wise are quiet and few.
---

bert stoltenborg
science forum addict

Joined: 16 May 2005
Posts: 52

Posted: Mon May 08, 2006 12:38 pm   Post subject: Re: reverb in long halls / corridors   quote

He Chris,

Not totally on topic, but maybe interesting:
I know these problems have been under investigation by a dutch
speaker company. They did tests and suggested to use High DI line-
arrays using ribbon speakers radiating sound in an open baffle, so
figure of 8 radiation.
I guess this solution was to expensive :-)

Bert

Savant
science forum beginner

Joined: 07 Jun 2005
Posts: 13

Posted: Wed May 10, 2006 2:09 am   Post subject: Re: reverb in long halls / corridors   quote

Hey Chris! Good to see you here. I appreciate all the tools you've
made available these last few years. You're a true acoustical saint!
:-)

Chris Whealy wrote:
> **Quote:**
> > 1) For rooms where the dimensions are similar, Fitzroy's
> > equation is able to predict flutter echo (one reverb time will be
> > significantly longer that the other two).

I am not sure I understand what you're getting at here. A flutter echo
is a transient wave phenomenon dependent on the distance between
two or
more surfaces. Do you mean to say the Fitzroy equation will *imply*
a flutter echo by calculating a higher RT for one direction when the
absorption is concentrated in the other(s)? Or do you mean to say
the flutter echo itself would somehow be predicted mathematically?

> **Quote:**
> > The voice of ignorance speaks loud and long,
> > But the words of the wise are quiet and few.

Sorry for being so loud! :-D

---Savant---

Chris Whealy
science forum addict

Joined: 05 May 2005
Posts: 54

Posted: Wed May 10, 2006 7:39 am   Post subject: Re: reverb in long halls / corridors   quote

Savant wrote:
> **Quote:**
> > Hey Chris! Good to see you here. I appreciate all the tools
> > you've made available these last few years. You're a true
> > acoustical saint!
> > 😃

Aww gee, I've gone all shy....

(Adjusts halo) :-P

> **Quote:**
>
> I am not sure I understand what you're getting at here. A flutter echo is a transient wave phenomenon dependent on the distance between two or more surfaces. Do you mean to say the Fitzroy equation will *imply* a flutter echo by calculating a higher RT for one direction when the absorption is concentrated in the other(s)?

Yes. On my Control Room Calculator spreadsheet (sheet "Initial Values"), there's an RT60 graph that shows the on-axis reverberation time using Fitzroy's equation.

If this graph shows that the reverberation time on one particular axis will be greater than the other two axes, then this should be recognised as a warning sign that a flutter echo will probably occur.

> **Quote:**
>
> Or do you mean to say the flutter echo itself would somehow be predicted mathematically?

Well that's sort of what will happen given the explanation above. It would be more accurate to say that the on-axis reverberation times given by Fitzroy's equation can be used as early warning indicators of the likelihood of a flutter echo.

Without performing further calculations, I don't think the word "predict" is helpful here.

I haven't examined this point in much detail, but I wonder what time difference there needs to be for the RT on one axis to be perceived as a flutter. 10% longer, 20% longer?

Answers on a post card...

> **Quote:**
>
> The voice of ignorance speaks loud and long,
> But the words of the wise are quiet and few.
>
> Sorry for being so loud! :-D

Sorry for being so quiet!! :-P

Chris W

--
The voice of ignorance speaks loud and long,
But the words of the wise are quiet and few.

Savant
science forum beginner

Joined: 07 Jun 2005
Posts: 13

Posted: Fri May 12, 2006 1:11 am   Post subject: Re: reverb in long halls / corridors

Chris,

I understand. And that is a very good application of Fitzroy's equation. Was it in his original paper? (It's been a long time since I read it.) Thanks for clarifying.

Also...how best to put this? I think flutter and RT are distant acoustical cousins, but not siblings. Before I start getting to philisophical on the subject, I should probably refer you to Maa's JASA
paper, "The Flutter Echoes" (October 1941). In it, he gives the equation(s) to calculate flutter echoes. You might also check out this thread, if you haven't already seen it:

http://forum.studiotips.com/viewtopic.php?t=1441&highlight=flutter+echo

Thanks again, Chris! :-)

---Savant---

Chris Whealy
science forum addict

Joined: 05 May 2005
Posts: 54

Posted: Fri May 12, 2006 9:12 am   Post subject: Re: reverb in long halls / corridors

Savant wrote:
> **Quote:**
>> I understand. And that is a very good application of Fitzroy's equation. Was it in his original paper? (It's been a long time since I
>> read it.) Thanks for clarifying.

To be honest, I don't know. I haven't read read Fitzroy's original paper. However, I have read Reinhard Neubauer's comments on Fitzroy's equations and also how he believes the original equation can be improved.

See http://www.ib-neubauer.com/Literatur/ISSEM_99_Gdansk.pdf for details

> **Quote:**
>> Also...how best to put this? I think flutter and RT are distant acoustical cousins, but not siblings. Before I start getting to philisophical on the subject, I should probably refer you to Maa's JASA paper, "The Flutter Echoes" (October 1941). In it, he gives the equation(s) to calculate flutter echoes.

I've just downloaded this article, but haven't read it yet. It looks like something I can get my teeth into!

Quote:

> You might also check out this thread, if you haven't already seen it:
>
> http://forum.studiotips.com/viewtopic.php?t=1441&highlight=flutter+echo

Ok, I've pulled off the references quoted in the thread and will take a look at them when I get some time (maybe in the next year or so!! :-O)

Chris W

--
The voice of ignorance speaks loud and long,
But the words of the wise are quiet and few.