

Asunto: **The sound waves involved in double-glazed windows**

I am currently doing a project about double-glazed windows. Some of the characteristics of those windows is that

- a) using two glass sheets of different thicknesses will let through less sound than using glass sheets of the same thickness
- b) NOT mounting the glass sheets completely parallel to each other will also reduce the amount of sound let through (this fact is used in recording studios).
- c) having the two sheets of glass mounted very close to each other will make a sound insulation system which may even work worse than a single-glazed system.

I have performed experiments to check those hypothesises and they appear to be valid. However, my teacher (no, I am not a professional scientist. In fact, I am very unprofessional) believed the amount of sound let through depended wholly on the air gap and the air between the sheets of glass vibrating. That is probably only part of the truth, because the physical vibrations of the actual glass sheets (chladni figures may be applicable) seem to be just as important in eg. hypothesis a).

The problem: Neither me, nor my dear physics supervisor now know how exactly the results of the experiment should be analyzed, or even if it is the physical vibrations of the glass sheets or not that is the variable which affects the results. There are also other factors we are unsure of, concerning the frequencies of the sounds let through, and I would love to give more details if there is anyone in this newsgroup who knows anything about the way sound travels through glass, especially the way sound changes direction or spreads when changing medium. Or someone that knows anything at all about anything at all (eg. chladni figure) which they believe could be helpful for this project.

I apologise for just jumping into the newsgroup without getting to know you and without finding out whether this is the right newsgroup for this topic at all (after all, not all physics newsgroups seem to be concerned with sound), but time is running out for me and I am not getting much wiser... so helping hands are welcomed.

--
sandra Barcella
<|~°P;''

P.S. I would be very pleased if anyone who knows something about this topic and writes to me about it would also include information such as his or her name and also accept that I can use the information he or she gives me for my projects, so that I will not have unknown sources in my project. Thank you in advance.

alt.sci.physics.new-theories, alt.sci.physics.plutonium, alt.sci.physics.spam

: all...@tele.ntnu.no (Rune Allnor)

cha: 30 Aug 2002 01:40:23 -0700

cal: Vie 30 ago 2002 10:40

unto: Re: The sound waves involved in double-glazed windows

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"sandra <| ;'" <sandr...@telia.com> wrote in message

<[news:OGtb9.4903\\$e5.743803@newsb.telia.net](mailto:news:OGtb9.4903$e5.743803@newsb.telia.net)>...

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> the results of the experiment should be analyzed, or even if it is the
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> affects the results. There are also other factors we are unsure of,
> concerning the frequencies of the sounds let through,

The analysis of sound propagating in layered media is standard material in seismics and physical acoustics. While there are many textbooks available that treat this kind of analysis, I think the most to-the-point introduction is a paper that was published a few years back:

Hovem: Acoustic waves in finely layered media

Geophysics, July-August 1995, Volume 60, Issue 4, pp. 1217-1221

Here you will find an analysis of how material parameters and layer thicknesses influence the transmission of sound through media like your window, as function of frequency.

Rune

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alt.sci.physics.new-theories, alt.sci.physics.plutonium, alt.sci.physics.spam

: h.a...@terra.es (Higini Arau Puchades)

cha: 31 Aug 2002 02:45:15 -0700

cal: Sáb 31 ago 2002 11:45

unto: Re: The sound waves involved in double-glazed windows

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"Sandra wrote:

> I am currently doing a project about double-glazed windows. Some of the
> characteristics of those windows is that
> a) using two glass sheets of different thicknesses will let through less
> sound than using glass sheets of the same thickness
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> also reduce the amount of sound let through (this fact is used in recording
> studios).
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> a sound insulation system which may even work worse than a single-glazed
> system.

Hello Sandra,

I realized my doctoral thesis, ("Contribucion al estudio de la atenuacion sonora de dobles y triples paredes simétricas, asimétricas, isotrópicas, homogéneas y viscoelásticas". (1984. Barcelona University)), in this aspect, extended to any material, for single, double and triple walls. Many part of this subject was published in ABC de la Acustica Arquitectónica. (1999) CEAC. The problem for you is in spanish, however the formulae are expressed in the language common and universal for all persons.

Many questions by you asked have been developed in:

Quirt, J.D. Sound Transmission trough windows: 1. Single and Double Glazing.

J.Acoust.Soc.Am 74(2). August 1983

Quirt, J.D. Sound Transmission trough windows: 1. Double and Triple Glazing.

J.Acoust.Soc.Am 74(2). August 1983.

More information very detailed is supplied Saflex, search in google.

Cremer, L: Theorie der schall dämmung wände bei schrägem einfall.

Akustike Zitschrift VII, 1942.

A.London Transmission of reverberant sound trogh double walls,

J.National Bureau Standards Vol 42, paper RP1998. (1949)

A.London Transmission of reverberant sound trogh double walls,

J.Acoust.Soc.Am 22(2). 1950

H.Arau: A new contribution to the study of sound transmission los of single walls, Fortschritte de Akustik FASE/DAGA '82 (Vol.1, pages 267-270), 1982.

I can to supply you many much information.

Answering to the questions indicated by, we have:

Point a) Yes it is true, but the critical frequencies of glasses must be well different among them trying that that the lowest critical frequency be very high in frequency, because that if we have a great chamber among glazing panes then is powered the transmission loss TL very much in the frequencies below to the critical frquencies. If you put in this case absorption in the perimeter frame of the chamber then you will improve more the TL.

Point b) J.D. Quirt, before indicated, showed by experimental analysis that this question is not important. The inclination, or not parallelism among glasses is not important for improve the TL.

Point c) Yes, it is true. Because in this case is very important the air cavity resonance among glasses. This resonance frequency is placed in the mean audible spectrum. Normally we have very much problems with the critical frequencies, that ever are producing a troubelsman, that now in addition we have the resonance frequency that does a great dip of TL. The glases with very few cavity are called thermal glasses. I hope that my information be useful for you

Higini

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[alt.sci.physics.new-theories](#), [alt.sci.physics.plutonium](#), [alt.sci.physics.spam](#)
: "Noral D. Stewart" <no...@ix.netcom.com>

cha: Sat, 31 Aug 2002 07:56:50 -0400

cal: Sáb 31 ago 2002 13:56

unto: Re: The sound waves involved in double-glazed windows

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Higini Arau Puchades wrote:

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> of TL. The glases with very few cavity are called thermal glasses.
> I hope that my information be useful for you

> Higini

I am not sure the original poster Sandra understood that the most important resonance is the one you discuss, the mass-air-mass resonance, and not resonances due to the dimensions of the glass itself as would occur with a single pane of glass. Sandra, while those resonances may be factors in some cases, they are usually secondary factors. The mass-air-mass resonance effect is well understood. The frequency at which it occurs is easily predicted.

Also, to reinforce what Higini said, there is no strong evidence that angling one of the panes really helps and most evidence indicates it does not help. Glass is often angled in studios to prevent light reflections and to even reflect sound in a different direction.

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[alt.sci.physics.new-theories](#), [alt.sci.physics.plutonium](#), [alt.sci.physics.spam](#)
: h.a...@terra.es (Higini Arau Puchades)

cha: 31 Aug 2002 11:35:41 -0700

cal: Sáb 31 ago 2002 20:35

unto: Re: The sound waves involved in double-glazed windows

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Noral D. Stewart wrote:

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> angling one of the panes really helps and most evidence indicates it
> does not help. Glass is often angled in studios to prevent light
> reflections and to even reflect sound in a different direction.

Hi Noral,

Yes, you have reason, the resonance that I wished to speak is due to the coupling mass-air-mass.

With reference to the inclination among panes many people think that it improve TL, however I think with you that it may be more useful to avoid a something bad reflection produced in the room, or as you say to avoid light reflections.

Very thanks for this correction.

Higini