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STUDIO TUNER SELECTION

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Not surprisingly, over the years studios used for television and broadcast have become even more critical in their specification and the expected achievement of this specification. Obviously, the key feature is the low background noise levels from structure-borne noise control. The acoustics of the internal environment most traditionally expressed by the reverberation time has also demanded attention, and it is many years ago since the BBC Research Centre at Kingswood Warren developed a range of studio tuners, the absorptive action of which could best be described as a mixture of surface absorption and Helmholtz resonators. Today in TV studios large quantities of these are employed, mainly as a result of their predictable performance. However, they did start life very much more for the performance which their name suggests - tuning - where they were employed in smaller studios, more especially for speech-work, where characteristic model resonances showed up to detriment in the quality of the reproduced voice.

Hence, a large range of options and constructions were contrived in an attempt to produce units whose peak absorptive powers were concentrated over limited bandwidths of one octave width, and even approaching ⅓ octave bandwidths.

The tuners were constructed as box units approximately half a metre square, and were assembled into the studio in such a manner as to allow individual substitution. Hence, on commissioning the studio, any weaknesses detected primarily from reverberation time measurements could be adjusted and the studio optimised.

Nowadays they are employed in a much more broad-brush manner, also with appearance in mind, in large TV studios. The construction is fairly basic, being in the case of Sound Attenuators Ltd. a 600mm square metal box of specified depth, in which cavities are created by metal or cardboard dividers and above which various flow resistances are incorporated by employing perforated metal of controlled percentage open area and mineral wool. To some extent the perforations can be considered as the necks of Helmholtz resonators. In a fairly straightforward manner, 18 tuner options have been evolved to cover the frequency range required, including broader band absorbers. The performance of each design has been measured in 5 x 5 sets, with the correct rear cavity and module spacing, in a classic 200m^3 reverberation chamber to establish the corresponding classical absorption coefficient to random incident sound. It must be noted that the gaps are an essential feature of the performance and equally a necessity of the support system and the need to individually substitute absorber elements in an interchangeable manner.

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Nevertheless, this flexibility to choose between 18 types equally puts a demand on the need to actually choose as correctly as possible at the design stage, as necessarily the few hundred studio tuners have to be appropriately ordered in the first place. To some extent, experience is an obvious method for trial selection, but even here the selection has to be checked each time. The number of such experienced people is limited, and in our case it would be preferable if all our 30 sales engineers and 15 consultants could equally access and command the correct selection. Hence, two techniques have been evolved; a manual technique and an automatic iterative technique.

Manual

For this case we have employed a desktop computer as a powerful and rapid pictorial calculator. We have employed Eyring's formula for the calculation of reverberation time, whilst fully realising that the laboratory's values of absorption coefficient were obtained by the use of reverse Sabine formula. This could be an interesting acoustic discussion point. The input to the computer is fairly straightforward, requiring the room volume, the total surface area, the floor area (hard or carpeted) and the option to pre-select a mid-range reverberation time when the TBA curve will be employed or the incorporation of a unique ⅓ octave reverberation time requirement. This is the line which appears on the screen as a plot of reverberation time against frequency. For reasons of commercial sponsorship, the absorption units are in surface area blocks of 600mm x 600mm. It is assumed then that the rest of the wall and ceiling surface area is concrete. General performance absorption coefficient such as curtains, wooden panels, etc., can be included either in the main computer bank (which includes the 18 absorbers mentioned above), or as a dedicated entry at the time of calculation. One then, just by trial and error and experience, chooses quantity selections from the absorbent types and a calculated reverberation time appears superimposed on the selected curve. Manual trial and error continues until a satisfactory fit is compromised.

Automatic

However, whilst this has proved fairly useful, we have extended the desk computer to its extreme computational abilities and made this process or curve matching automatic. Again, the required reverberation time is entered and a guessed selection is made from a limited range of eight types. The program asks how many of each type is required, gives you the option to vary each type or to keep it constant, requires that for variable elements you choose a lower and upper limit to the number of unitary absorbers, and it is required to state the number of absorbers to be changed in each step - usually ten at a time. After a first calculation, it displays the first guess. It then requests a necessary error limit required for the final reverberation time with respect to the requested reverberation time, and this is stated as an overall deviation on the average and is chosen around 0.1 seconds. The computer then sets to work in an iterative manner, the program for which must not be under-estimated for its complexity or originality. In reality it seems to concentrate on the lower frequency approximation most strongly, although this is not a feature of the design.

Whilst the design goal and the latest calculations are displayed as bright yellow lines, the previous calculations are retained as a background of red lines. When a best fit has been found, the display clears down to just the yellow lines, which are then printable and plottable.