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The effect of diffusers on low frequency modes

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Small listening rooms are becoming prevalent, due to the availability of production facilities on personal computers, and the financial pressures faced by the industry. In these rooms, modal behaviour at low frequencies significantly affects the quality of the reverberant decay, due to their non-diffuse nature compared with other frequencies. Diffusion and absorption can help and may be a useful way of improving the low frequency performance of such rooms. This paper discusses the properties of these rooms at low frequencies, in particular the effect of diffusing boundaries on the modal behaviour of such rooms. The paper will first discuss what is meant by a mode and modal decay. It will then go on to examine the effect of diffusing boundaries on the frequency and density of modes. In particular, it will examine the effect of the scale of the diffuser on its efficacy in this task. For ease of visualisation this will be done using a two dimensional model and, for accuracy a finite element, element simulation. The effect of going to three dimensions on the results will also be discussed. Finally, the effect of absorption based diffusing boundaries will be examined.