

# **INTERNATIONAL ROUND ROBIN ON ROOM ACOUSTICAL COMPUTER SIMULATIONS**

**Michael Vorländer**

Laboratory for Building Acoustics, Physikalisch-Technische Bundesanstalt  
(PTB), Bundesallee 100, D-38116 Braunschweig, Germany

## **SUMMARY**

14 different programs for room acoustical computer simulations were compared regarding the results of 8 acoustical criteria (T, EDT, D, C, TS, G, LF and LFC) in a speech auditorium. 2 source positions and 5 receiver positions were chosen and the criteria were calculated for the 1 kHz octave band. The simulations were carried out by 16 participants independently, most of them the developers of the software. Measurements were performed correspondingly by 7 participants. The project was run in two steps: first without information on the measurement results, the room geometry and the material data being provided on the basis of construction plans and material descriptions in words. Secondly, the simulations were repeated using the same absorption coefficients throughout the hall.

The results of the first phase showed a surprisingly large scatter with a strong tendency to underestimate the absorption coefficients and thus to overestimate the reverberation time. Some results were totally wrong due to a false interpretation of the parameter definitions. In the second phase the agreement was, of course, better but even with harmonized input data some results varied considerably from others. Only three programs can be assumed to give unquestionably reliable results. The results of these programs differ from the measurement results by an order of magnitude of the standard deviation of the average measurement result. This order of magnitude is also approximately the same as for the subjective difference limens of the acoustical parameters. Some of the other programs have produced differences of up to 5 - 6 times the subjective limens.

There are indications that some systematic shifts in the results may be caused by neglecting wave effects, namely of the attenuation of sound at grazing incidence over the audience or seating. It also seems to be necessary to include diffuse reflections in the algorithms, at least from the 2nd to 4th order, since the results from purely "specular approaches" were more outlying than algorithms with some kind of random reflections or statistical reverberation tails.