

TIMBRE AND PITCH OF RUSSIAN CHURCH BELLS

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Background

Since the 9th century a distinct style of performance on Russian church bells had been created, in which the leading role belonged to rhythm and harmony rather than melody. As there is a trend nowadays to revive this art, while the technology to build and tune these bells has been lost in the Bolshevik era, the research on their acoustic parameters, the methods of their tuning as well as their timbre and pitch has a special relevance.

Aims

The aim of this research is a new complex of works on recording, storing, restoration and analysis of sound examples of Russian church bells, using modern digital technologies including spectral and statistical processing, to determine their peculiarities and acoustical characteristics.

Method

The recordings and acoustic analysis of bells built between the 16th and the early 20th century were either made on the belfries of actual churches or in museums of Northwest and Central Russia. Because of the above mentioned loss of technology, most bells built since the Bolshevik Revolution comply to the Dutch tuning, which creates a significantly different timbre.

Results and Conclusions

The analysis of statistical data for Russian church bells shows that the deviation from Dutch tuning is rather considerable. The rate and character of decay processes depend on bell's sizes, form, material, place, method of strike and others. Spectral measurements show that the most ancient Russian church bells have many very tight-spaced doublets (two or more closely spaced partials), which produce their specific timbre during the decay process.

Moreover, the analysis of the nodal lines on the surface of most big church bells shows that these lines move during the sounding, which results in the effect of a "floating" sound, a special type of amplitude modulation. The reason for this effect is the nonlinear vibration of the bell's shell under the strong clipper strike.