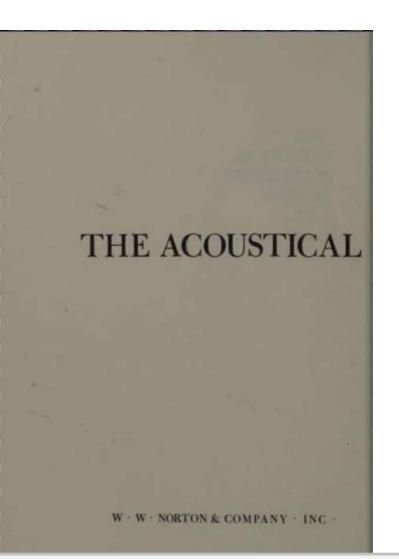JOHN BACKUS

The Acoustical Foundations of Music

Musical sound: its properties,
production, behavior,
and reproduction

Second Edition
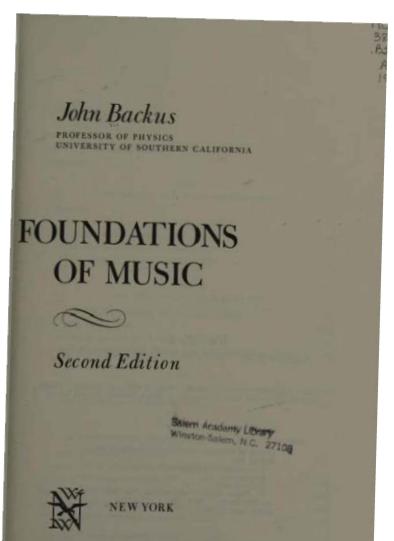
THE ACOUSTICAL

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FOUNDATIONS
OF MUSIC

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CHAPTER FOUR

COMPLEX
VIBRATIONS
AND RESONANCE

Now that we have discussed wave motions and their transmission through the medium, we are equipped to examine vibrating systems whose behavior is more complicated than those discussed earlier. These more complex systems are the acoustical foundations for the various families of musical instruments.

The Vibrating String: Standing Waves

The simple systems considered earlier had essentially only one vibration frequency. There are actually not very many systems of this kind; most things that can vibrate can do so in more than one way. The string stretched between two supports is an example of such a system, and one that has very important musical applications.

To analyze the behavior of the string fixed at two ends, we make use of an artifice. We first imagine the fixed points to be moved off to infinity, right and left, but with the tension in the string kept the same. (Infinity may be defined as a place so far away that if it is any farther, it doesn't matter.)

We then have the long string already discussed in Ch. 3; let us sup-

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