A Conventions

The following conventions will be used in the book. Exceptions will be clearly noted in the respective Sections.

Time Factor

- The time factor for harmonic oscillations and waves is $e^{j\omega t}$; $j = \sqrt{-1}$.
  This choice implies that the imaginary part of *impedances* with mass reaction are positive, with spring reaction negative, and the imaginary part of *admittances* with mass reaction are negative, with spring reaction positive.
- If not stated differently, the time function is assumed to be $e^{j\omega t}$; the time factor then is dropped, mostly.

Impedance and Admittance

- The term *impedance* is used for the ratio of sound pressure p to the vector component v of particle velocity in some specified direction, $Z = p/v$.
- *Mechanical impedance* is used for the ratio of a vector component of force F to particle velocity v in that direction, $Z_m = F/v$.
- *Flow impedance* is used for the ratio of sound pressure p to volume flow $q = S \cdot v$ through a surface S, with v the velocity component normal to S.
- *Admittance* is the ratio of the vector $\vec{v}$ of particle velocity to sound pressure p. The admittance is is a true vector (in contrast to the reciprocal of an impedance).
- *Mechanical admittance* is the reciprocal of mechanical impedance.
- *Flow admittance* is the ratio of the flow vector $\vec{q}$ to sound pressure; it is a true vector.

Sound Intensity and Power

Sound intensity is the vector $\vec{I} = p \cdot \vec{v}^*$ (where the asterisk indicates the complex conjugate); $\vec{I}$ stands for the oscillating sound power in the direction of $\vec{v}$ through a unit surface. The *effective* (or *active*) *intensity* is the real part thereof in the time average; the *reactive intensity* is the imaginary part of the time average. (The formally possible definition $\vec{I}^* = p^* \cdot \vec{v}$ would produce conflicts at sound sources, and should be avoided, therefore.)

Sound power is the integral of the scalar product of sound intensity with the surface element vector $d\vec{s}$ over a surface S: $\Pi = \int_S \vec{I} \cdot d\vec{s}$.

Dimensions

Mostly in mks units. Where necessary, the dimension of a quantity is indicated in brackets [...].

Complex Quantities

Field quantities, such as sound pressure p, particle velocity v, oscillating parts of density ρ, and temperature T, etc. are mostly complex. If one records such a quantity in an oscillogram, one may take either the real or the imaginary part of a complex expression, after multiplication by the dropped time factor. If one records the amplitude, this corresponds to taking the (absolute) magnitude of the complex quantity.

Symbol "Decorations"

Unnecessary symbol decorations, such as hats for amplitudes, underbars for complex quantities, etc. are avoided. If necessary in the local context, an arrow indicates a vector $\vec{v}$; a star is used for the complex conjugate p^*; primes are used either for the derivative of functions, $f'(x)$, $f''(x)$, or (where no ambiguity is possible) for the real and imaginary parts of complex quantities, $p = p' + j \cdot p''$.

Commonly Used Symbols

The following symbols are commonly used in most sections of the book. If a section uses the same symbol with a different definition, it will be noted.

c_0	adiabatic sound speed in the medium (e.g. in air) [m/s];
f	frequency [Hz];
j	$= \sqrt{(-1)}$ imaginary unit;
k_0	$= \omega/c_0$ free field wave number of a plane wave [1/m];
p	sound pressure [Pa] = [N/m^2]; *)
q	volume flow [m^3/s]; *)
t	time [s]= [sec];
v	velocity [m/s];
Z_0	$= \rho_0 c_0$ wave impedance of free plane wave [Pa·s/m];
α	sound absorption coefficient;
κ	adiabatic exponent of the medium;
λ	wavelength [m];
λ_0	wavelength of free plane wave;
ρ	mass density [kg/m^3];
ρ_0	mass density of the medium;
ω	$= 2\pi \cdot f$ angular (or circular) frequency [1/s]; *)
ϑ	polar angle of cylindrical or spherical co-ordinates;
φ	azimuthal angle of spherical co-ordinates;
Π	power;
Ξ	$\Delta p/(d \cdot v)$ flow resistivity of porous material [Pa·s/m^2] (flow resistance per unit thickness d)

*) See Preface to the 2nd edition

Numbering of Equations

Equations are numbered, beginning with number (1) in each Section. Reference to an equation is made as, e.g., "Eq. (x)" to an equation with number (x) in the same Section, or as, e.g., "Eq. (K.y.x)" to the equation with number (x) in the Section with number y of the Chapter K.

Conversions in Plot Labels

Some diagrams were generated by the computing program *Mathematica*®. This program has lost its ability to write plot labels in a suitable form for exportation to text or graphic programs. Equivalences between general notations and plot label forms will be marked near the plots, if necessary.