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AcuVib -

A Toolbox for Acoustic and Vibration Engineering

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Abstract

Engineers that are working with acoustic and vibration (as myself) now and then use formulas and information from books such as Beranek ”Noise and Vibration Control”, Blevins ”Formulas for Natural Frequency and Mode Shapes”, B&K ”Acoustic Noise Measurements”, ”Mechanical Vibration and Shock Measurements”, Handbooks and International Standards. It is time consuming to find the relevant formulas and keying in the formulas and numbers on calculator when they are needed. There is also an obvious risk for mistakes when keying in data on a hand-held calculator.

The aim has been to collect information and formulas in a series of computer programs for practical use. The programs have been developed in 32-bit Visual Basic for Windows 95/98/NT. The AcuVib program consists of a Main-program (a menu), and more than 50 Sub-programs. Examples of Sub-programs are: dB converter, A-C weighting of spectra, sound power - sound pressure calculations for outdoor and indoor conditions, barrier, composite transmission loss (mass law), reverberation time, resilient skin, Helmholtz resonators, cut-on frequency for pipes, expansion chambers, Aeolian tone, acceleration-velocity-displacement lin-log relationship for vibration, vibration isolation, resonance frequencies of dual systems, damping relationship, resonance frequency of plates and beams, shock isolation, unbalance force, fan noise, firing frequency of combustion engines, blow off noise, dynamic data of solid materials, point mobility, critical frequency, bending wavelengths etc.

Background information and examples of engineering problems where the programs have been used are presented.

1. Introduction

One day I just decided to put many of the engineering formulas that I had used in my work during 20 years as an acoustic consultant. It was more interesting than looking on TV or solving crosswords. However, my dear wife was not always so enthusiastic about the programming on free time during evenings and nights.

2. Specification

The following sub programs are included:

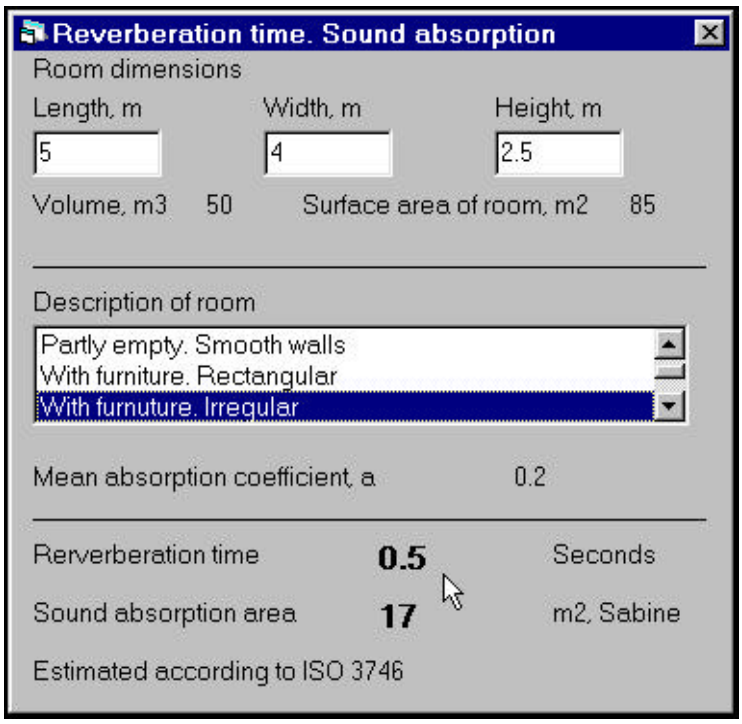
Light	*Pro*	*Subprograms. Version 3*
		General
x	x	Addition of levels
x	x	Addition of equal levels
x	x	Correction for background levels
x	x	Equivalent continuous level
x	x	Weighting of spectra. A-, C, Lin
x	x	A-, C - filter
x	x	Octave bands
	x	RMS-Peak
	x	dB Converter
		Acoustics
x	x	Outdoor. Sound pressure levels at different distances
x	x	Outdoor. Sound power - Sound pressure level
x	x	Indoor. Sound pressure levels at different distances
x	x	Indoor. Sound power-sound pressure
x	x	Barriers
	x	Sound transmission loss. Single wall
	x	Air cavity resonance. Double wall
	x	Resilient skin
	x	Composite transmission loss
	x	Road traffic noise reduction
x	x	Reverberation time. Absorption. Estimation acc to ISO 3746
x	x	Absorption. Calculation from reverberation time
	x	Standing waves in rooms
	x	Standing waves in tubes
	x	Cut on frequency for ducts
	x	Expansion chamber
	x	Helmholtz resonance
	x	Aeolian tones
x	x	Wave length in air. Temperature
		Vibration
x	x	Acc-vel-disp
x	x	Linear-Logarithmic. Acc-vel-disp
x	x	Logarithmic- Linear. Acc-vel-disp
	x	Resonance frequency. SDOF
	x	Vibration isolation. SDOF
x	x	Vibration isolation from static deflection. SDOF
	x	Resonance frequencies. TDOF. Two-degree-of-freedom

	x	Beams. Natural frequencies
	x	Plates. Simply supported. Natural frequencies
	x	Combined springs
	x	Damping
		Shock
	x	Shock isolation. SDOF
		Machinery
	x	Unbalance forces
x	x	Fan noise: Speed changes
	x	Fan noise. Flow and pressure
x	x	Blade passing frequency
	x	Combustion engine. Firing frequency
	x	Root blower. Pulse frequency
	x	Air cooling
	x	Steam blow off noise
		Data
	x	Solids. Database. E-modulus. Critical frequency. Point mobility. Wave length
	x	Water
x	x	Singing of ice

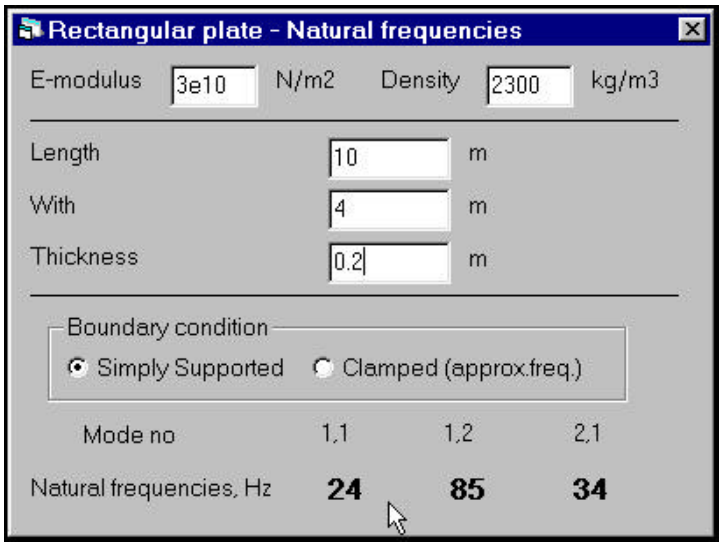
3. Examples of engineering calculations

Problem 1

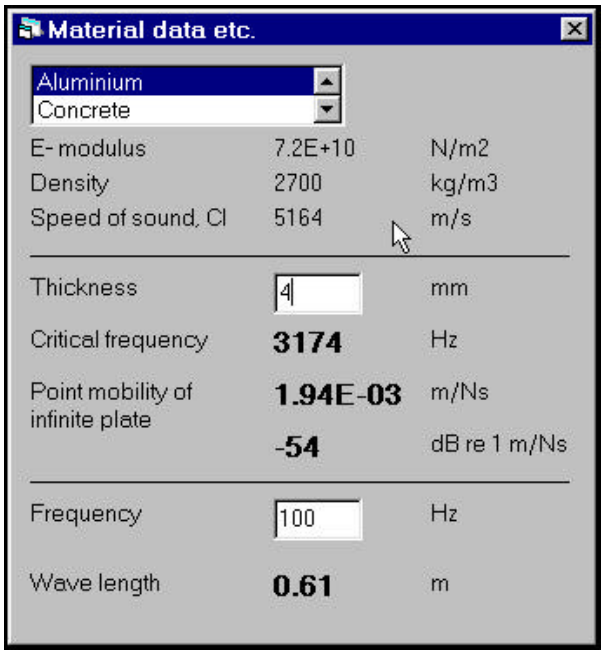
Estimate the reverberation time of a room.



Problem 2
Find the natural frequencies of a concrete slab:



Problem 3
Find basic acoustic data of an aluminium plate



4. Conclusion

The toolbox is easy to find; it is just an icon on the screen. Now the program is saving much of my time, and my wife is happy again. (Additional info:www.acuvib.com)