



## PiezoCAD® Versions

### Transducer Modeling Software

PiezoCAD® 3.06

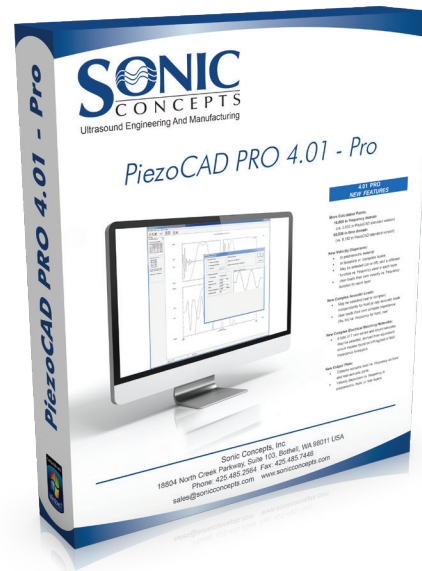
PiezoCAD® PRO 4.01

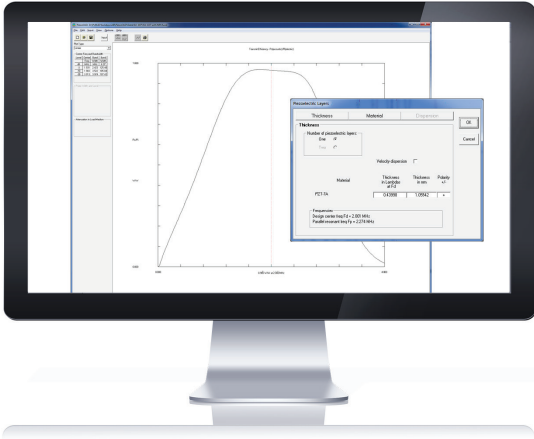
#### NEW PRO VERSION FEATURES:

- Complex Acoustic Load Impedances on the Front and Rear Ports
- Velocity Dispersion in each Piezoelectric and Acoustic layer on the Front and Rear
- Additional Customized Features for Modeling Available Upon Request

## HOW IT WORKS

PiezoCAD® uses a chain matrix technique to calculate the overall system characteristics from the electric terminals to the front acoustic port. The user can select piezoelectric material parameters from extensive piezoelectric database tables, including plate, beam, and bar mode elements in ceramic, crystalline, polymer and composite materials. The user can enter multiple acoustic matching and backing layers from acoustic database tables, as well as load medium characteristics. Thickness, velocity, attenuation, and cross-sectional area can be entered for each layer. PiezoCAD® and acoustic material database tables can be updated from within PiezoCAD® or edited directly using Microsoft Access.





## 4.01 PRO NEW FEATURES

### More Calculated Points:

- 16,000 in frequency domain  
(vs. 2,000 in PiezoCAD standard version)
- 65,536 in time domain  
(vs. 8,192 in PiezoCAD standard version)

### New Velocity Dispersion:

- In piezoelectric material
- In faceplate or backplate layers
- May be selected (on or off), and a different function vs. frequency used in each layer
- User loads their own velocity vs. frequency function for each layer

### New Complex Acoustic Loads:

- May be selected (real or complex) independently for front or rear acoustic loads
- User loads their own complex impedance (Re, Im) vs. frequency for front, rear

### New Complex Electrical Matching Networks:

- A total of 7 new series and shunt networks may be selected, derived from equivalent circuit models found on HP/Agilent 4194A Impedance Analyzers

### New Output Plots:

- Complex acoustic load vs. frequency on front and rear acoustic ports
- Velocity dispersion vs. frequency in piezoelectric, front, or rear layers

## PiezoCAD® Information

### MATCHING NETWORK

On the electrical port, the user can specify a matching network including any combination of series of shunt resistors, inductors, or capacitors, transformers, coaxial cable and multiple identical piezoelectric layers that are electrically connected in parallel. The user can enter any desired frequency range for the calculations, including calculating transducer response characteristics at higher harmonics.

### OUTPUT

PiezoCAD® output includes a selection of acoustic and electric input impedance functions; transmit and receive power conversion efficiencies; transmit, receive, and pulse-echo transfer functions and time domain waveforms. All calculated results are given in MKS units and provide quantitative design performance. For example, transmit transfer functions are given in units of Pascals/Volt, where displayed function is the pressure in Pascals at the front face of the transducer per drive volt, versus frequency. The user can quantitatively assess the transducer response to various transmitted voltage or received pressure waveforms. A tone burst excitation waveform can be specified within PiezoCAD®. Alternately, the excitation waveform can be loaded from an external data file that the user creates with their own software.

### PULSE-ECHO CALCULATIONS

Pulse-echo calculations allow the user to view the round-trip response of a transducer, including optional attenuation in the load medium. A cursor function is available on all plots, allowing the user to read graphical values directly. The analytic envelope of the pulse is calculated using a Hilbert transform technique and displayed on all time domain waveforms. By clicking on any plot, the user can adjust the amplitude and frequency or time scales as desired. Calculated results can be output to a file for later use in PiezoCAD®. The user can optionally output selected graphs to other Windows applications, and numerical data can be saved to a file that is compatible with popular spreadsheet programs.