

Speed of Sound in Various Fluids

Introduction

This application computes and tabulates the speed of sound in various fluids at standard temperature and pressure, as provided by the [ThermophysicalData](#) package (which uses the open-source [CoolProp](#) project for fluid properties).

The list of fluids include water, ethanol, air, ammonia and several others. However, you can use any of the fluids in the ThermophysicalData package ([this](#) help page contains a list of available fluids).

This application also demonstrates the use of the [DocumentTools](#) package for tabulating and formatting results.

Compute the Speed of Sound

List of fluids

```
> fluids := ["Water", "Ethanol", "Ammonia", "Air", "Argon",
             "Helium", "Krypton", "Xenon", "Hydrogen", "Nitrogen", "Oxygen",
             "CarbonDioxide", "SulfurDioxide", "Ethylene", "Methane", "Propane"
            ]:
```

Compute the speed of sound for each gas

```
> sos := [ seq( ThermophysicalData:-Property( speedofsound, fluid,
        temperature = 293.15 * Unit( K ), pressure = 1 * Unit( atm ) ),
        fluid in fluids ) ]
```

$$\begin{aligned}
 \text{sos} := & \left[1482.346175 \frac{\text{m}}{\text{s}}, 1158.501696 \frac{\text{m}}{\text{s}}, 429.4034364 \frac{\text{m}}{\text{s}}, 343.3438897 \frac{\text{m}}{\text{s}}, \right. & (1.1) \\
 & 318.9590594 \frac{\text{m}}{\text{s}}, 1007.890969 \frac{\text{m}}{\text{s}}, 220.0722349 \frac{\text{m}}{\text{s}}, 175.5008844 \frac{\text{m}}{\text{s}}, 1304.669368 \frac{\text{m}}{\text{s}}, \\
 & 349.1044229 \frac{\text{m}}{\text{s}}, 325.9962839 \frac{\text{m}}{\text{s}}, 266.5555353 \frac{\text{m}}{\text{s}}, 217.0265892 \frac{\text{m}}{\text{s}}, 327.5210215 \frac{\text{m}}{\text{s}}, \\
 & \left. 445.0106227 \frac{\text{m}}{\text{s}}, 246.5878416 \frac{\text{m}}{\text{s}} \right]
 \end{aligned}$$

Tabulate the results

```
> results := [ [ "Fluid", "Speed of Sound" ], seq( [ fluids[ i ],
        evalf( sos[ i ], 5 ) ], i = 1..numelems( fluids ) ) ]:
```

```
DocumentTools:-Tabulate( results, color = ( ( T, i, jj ) -> `if`(
i = 1, white, black ) ), width = 250, widthmode = pixels,
fillcolor = ( ( T, i, jj ) -> `if`( i = 1, black, white ) ) ):
```

Fluid	Speed of Sound
Water	1482.3 $\frac{\text{m}}{\text{s}}$
Ethanol	1158.5 $\frac{\text{m}}{\text{s}}$
Ammonia	429.40 $\frac{\text{m}}{\text{s}}$
Air	343.34 $\frac{\text{m}}{\text{s}}$
Argon	318.96 $\frac{\text{m}}{\text{s}}$
Helium	1007.9 $\frac{\text{m}}{\text{s}}$
Krypton	220.07 $\frac{\text{m}}{\text{s}}$
Xenon	175.50 $\frac{\text{m}}{\text{s}}$
Hydrogen	1304.7 $\frac{\text{m}}{\text{s}}$
Nitrogen	349.10 $\frac{\text{m}}{\text{s}}$
Oxygen	326.00 $\frac{\text{m}}{\text{s}}$
CarbonDioxide	266.56 $\frac{\text{m}}{\text{s}}$
SulfurDioxide	217.03 $\frac{\text{m}}{\text{s}}$
Ethylene	327.52 $\frac{\text{m}}{\text{s}}$
Methane	445.01 $\frac{\text{m}}{\text{s}}$
Propane	246.59 $\frac{\text{m}}{\text{s}}$