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Interactive analysis, design, and teaching for thermoacoustics using DeltaEC

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The 2008 release of the Los Alamos thermoacoustics code, DeltaEC, is distinctly different from the text-based program that was first made available in 1993. The physics captured by "Design Environment for Low-Amplitude Thermoacoustic Energy Conversion" has been steadily extended over the years. Toroids and other acoustic network topologies are now possible, along with superimposed steady flow, time-averaged pressure gradients, gas diodes, Gedeon streaming, thermoacoustic mixture separation, and resonator vibration solutions. Eight different stack pore geometries are supported, and a powerful algebraic user language allows complex, custom results to be derived without source code revisions at Los Alamos.

Over the last year, the numerical methods of DeltaEC were condensed into a FORTRAN computational core and wrapped with a Python-based graphical user interface to provide modern interactive features: a multi-model tabbed interface, colorizing editors, scaled schematics, and 2D plotter windows. An intricate model can now be divided into interlinked sub-models that can be solved independently (and consistently). In addition to providing usability and new capabilities, the Python front end makes the legacy code more maintainable, extensible, and verifiable.

The latest download of DeltaEC is available to all researchers at www.lanl.gov/thermoacoustics/.