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Weakly non-linear thermoacoustics for general porous media

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A weakly nonlinear theory for thermoacoustics, including acoustic streaming, a temperature-dependent viscosity and slowly varying pores with arbitrarily shaped cross-sections, has been constructed by systematically applying dimensional analysis and small-parameter asymptotics. In this way a set of equations for the acoustic and streaming variables can be derived. For some simple cases explicit solutions can be found, such as the short-stack approximation, but for the more advanced applications we have to resort to a numerical solution. The theory has been implemented both for standing-wave and traveling-wave applications. For the case of a standing-wave system we have compared our computations with experimental data and found a remarkable agreement.