

# Multimode multiple wave scattering in suspensions of solid particles in viscous liquids: Part 1 asymptotic results; Part 2 numerical results

Valerie Pinfield and Tony Valier-Brasier, Proceedings of the Royal Society, 2024: Matlab files for multiple scattering calculations (Matlab v2023a)

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Note that the function w3j.m is a modified version of a function of the same name by Archontis Politis (copyright Archontis Politis 2015) and a license file is included in this bundle.

## *To run the code*

Use the script file scatter3DScript\_silicaExpt.m. You can edit the user settings in this file.

To produce the asymptotic data in Figure 1 (models E,F), use coeffOption=1, but use analytical asymptotic scattering coefficients for  $n=1$  ( by using the block starting at line 520 in the function scattCoeffECAH – by commenting out the %{} comment block).

Note that coeffOption=4 uses analytical coefficients for both T0 and T1.

## *Four functions are provided for calculating scattering coefficients:*

scattCoeffECAH: the Epstein/Carhart (1953) and Allegra/Hawley (1972) solution for a spherical penetrable thermally conducting elastic scatterer in a thermally conducting, elastic medium. This is currently set up to calculate a numerical solution to the boundary equations. The function is set to solve non-thermal boundary conditions (this can be edited); this is what was used in the PRSA 2024 papers. The code can be easily edited to provide the full numerical solution to the boundary equations with/without thermal effects.

scattCoeffACShell: the Anson/Chivers 1993 core-shell model used for a simple spherical scatterer

sphAcScattCoeff: the acoustic-only scattering coefficient for a spherical scatterer (no mode conversion)

scattCoeffAsympt: the analytical asymptotic expressions for scattering coefficients with mode conversion

## *Two functions are provided for calculating the multiple scattering models*

multiScattmultSpecies: produces results for models 1,2,6. This code can be used for systems of many scatterer types or different particle sizes (polydisperse).

multScattSolnMultiMode: produces results for models 1,2,3, 6,7. This code can only be used for systems with a single scatterer species and size (monodisperse).