Description of Mie Resonance Fitting (MRFIT) Examples

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1 Introduction

These examples should give the user an idea of how to use and format the `parameters.in` and `advanced.in` files as well as the proper formatting of the input list of Mie resonances.

2 Examples

There are currently five examples:

1. The peak locations taken from an extinction spectrum for a 4000 nm sphere with a constant refractive of 1.33 (calculated using Mie theory). Only first order modes between 630 and 670 nm were included (i.e. only sharp peaks). There are four mode sets here, with each set the accuracy of the mode positions is decreased by one significant figure.

2. The same mode sets as Example 1 except the mode assignments have been included in the input file, `water.dat`. Demonstrates how to input the mode assignments so that `MRFIT` can properly read them.

3. Two large mode sets (positions in nm) from Ref. [1]. The data is for ethanol droplets. The reported parameters of best-fit were: Frame 1: $m_0 = 1.366$, $m_1 = 0.964$, and $a = 7.133$ μm, Frame 2: $m_0 = 1.365$, $m_1 = 1.06$, and $a = 7.652$ μm.

4. The peak locations taken from an extinction spectrum for a 4000 nm sphere with a refractive index of $m = 1.3138 + 11.557/\lambda$, where λ is the wavelength in nm. The spectrum was calculated using Mie theory. Only first order modes between 630 and 670 nm were taken (i.e. only sharp peaks).

5. The peak locations taken from an extinction spectrum for a polystyrene sphere with a radius of 3000 nm and a refractive index described by

$$m = m_0 + \frac{m_1}{\lambda^2} + \frac{m_2}{\lambda^4},$$

where $m_0 = 1.5656$, $m_1 = 0.00785$ μm^2, and $m_2 = 0.000334$ μm^4 (taken from Ref. [2]). The extinction spectrum was calculated using Mie theory. Only the location of sharp peaks between 600 and 660 nm were taken. Note that, unlike the other examples here, the fit is done using the Cauchy expression for the refractive index. The flag for this is in `advanced.in`.

References

[1] J. D. Eversole, H. B. Lin, A. L. Huston, A. J. Campillo, P. T. Leung, S. Y. Liu, and K. Young, "High-precision identification of morphology-dependent resonances in optical processes in microdroplets," J. Opt. Soc. Am. B **10**, 1955-1968 (1993).

[2] S. Hill, C. Rushforth, R. Benner, and P. Conwell, "Sizing dielectric spheres and cylinders by aligning measured and computed resonance locations: algorithm for multiple orders," Appl. Opt. **24**, 2380-2390 (1985).