

higher frequencies representing the effects of the high order transverse modes in accordance with observation.

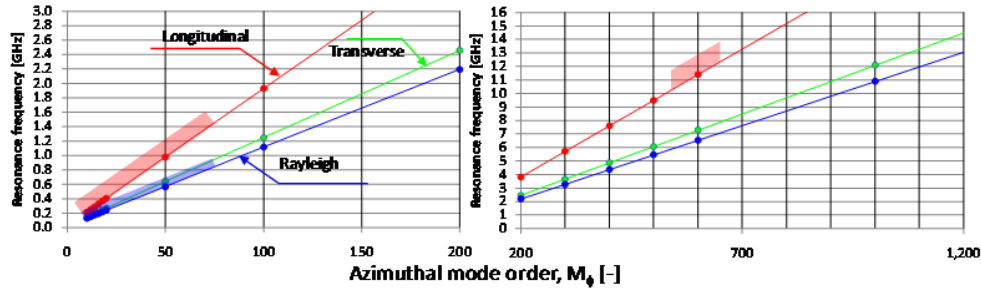


Fig. 5. Vibration frequencies for the various modes in a $r = 100$ micron silica sphere as a function of their azimuthal mode order. Left, with M_ϕ typical to forward Brillouin excitation. Right, with M_ϕ typical to backward Brillouin excitation. The shadowed regions estimate how high resonance frequencies can go for each of these modes via relying on high order transverse members of this mode family. The shadowed region is bounded in the M_ϕ direction as estimation from momentum conservation consideration. We assume excitation with 1.5-micron telecom pump.

4. Conclusion

Mechanical whispering gallery modes in a silica microsphere were calculated here to reveal a variety of deformations that are now experimentally possible in photonic-MEMS. As expected – as with previous studies in bulk materials - deformations including longitudinal-, transverse-, and Rayleigh-type resonances were calculated in the microsphere. However, while in bulk materials only the Rayleigh type deformation is a surface wave, here all of the deformation types are confined near the surface. Further, each of these modal families has members of different azimuthal, radial, and polar orders. Modes with different extension into the interface were calculated to support either enhancement or reduction of environmental effects upon need. We believe the new capacity to optically excite mechanical whispering gallery modes in microdevices will benefit from the numerical calculation presented here of the frequency, shape, and structure of these vibrations. For example, the strain distribution of these modes allow calculating their modal overlap with the optical modes [23], calculating their photoelastic index modulation [42,43], and calculating the amplitude of their Brownian fluctuation by comparison of their strain energy with the Boltzmann constant multiplied by temperature.