

Problem 10: magnetic levitation

A rectangular superconducting plate of mass m has four identical circular holes, one near each corner, see figure. Each hole carries a certain magnetic flux (all the four fluxes are equal and of the same polarity). The plate is put on a horizontal surface which is also in a superconducting state. The magnetic push between the plate and the surface compensates the weight of the plate when the width of the air gap beneath the plate is d , which is much smaller than the distance between the plate's and holes' edges (denoted by Δ in figure); d is also much smaller than the radii of the holes.

When the plate levitates in such a way above

the support, the frequency of its small vertical oscillations is ν_0 . Next, a load of mass M is put on the plate, so that the load lays on the plate, and the plate levitates above the support. What is the new frequency ν of small vertical oscillations (when the load and plate together oscillate up and down)?

