Two Dimensional Dipole-Dipole Interaction and Generalized Orbitals Under the Influence of Noncentral Forces

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In this investigation with two objectives we augment the scope of our previous analyses addressing the impact of two mutually interactive magnetic dipoles. First we deviate from restricting the movement of one of the loose magnets to one dimension; this is addressed in [1]. In this scenario the interactive force is a distance dependent function only. The resulting equation of motion is a nonlinear differential equation. Utilizing a computer algebra system, Mathematica [2] numeric solution of the equation of motion including viscosity is proven in agreement with data. Second, we apply our theory analyzing the orbitals of a loose particle under the influence of a hypothetical noncentral force [3,4,5]. Because of the noncentrality of the force the resulting equations of motion are coupled ODEs. Applying Mathematica and utilizing the numeric solutions deducing the orbits. In this current analysis by adopting the same strategy we utilize a realistic format for the mutual interaction force between two planar magnetic dipoles [6]. In this scenario one of the magnets is kept in place and the second one is mobile. The force is realistic, its format coincides with the fifteenth class of the forces reported in [5], namely, $f_{44}(r,\theta)\hat{r}+g_{44}(r,\theta)\hat{\theta}$, Table 1. Here depending to the orientation of two planar magnets we consider four different scenarios. For each situation we solve the associated coupled nonlinear differential equation of motions numerically; Mathematica provides the solutions. Utilizing the solutions we deduce the kinematics of the mobile magnet displaying the orbitals. We provide also an interactive Mathematica simulation program addressing the potential "what if" scenarios.

References

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