Finite-length swimmer in a nonlinearly viscoelastic fluid HENRY
FU, University of Nevada, Reno — Many swimming microorganisms naturally en-
counter non-Newtonian, viscoelastic fluids, including mucus in airways, the stom-
ach, and the reproductive tract. Most of the analytical work on swimming in such
complex media has involved swimmers of infinite length, in both two-dimensional
and three-dimensional geometries. I present an analytic calculation of a finite-length
three-dimensional swimmer, the Golestanian 3-sphere swimmer, in the limit of small
sphere radius relative to sphere separation and small displacement relative to sphere
radius. I discuss the effect of nonlinear viscoelasticity on the swimming speed and
on the internal forces exerted by the spheres on one another. Finite-length cor-
rections occur at second order in displacements, the same order as the Newtonian
swimming speed and the viscoelastic corrections observed for infinite swimmers. For
this finite-length swimmer, viscoelastic corrections to the swimming speed rely on
spatial asymmetry in the swimming stroke amplitude.

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