Optimized translation of microbubbles driven by acoustic fields.
JEAN TOILLIEZ, ANDREW SZERI, Mech. Eng., Univ. of California, Berkeley —
A single acoustically driven bubble translating unsteadily in a fluid is considered.
The inverse Reynolds number is identified as small perturbation parameter in the
translation equation. A closed-form, leading order solution for the bubble transla-
tion is obtained, assuming nonlinear radial oscillations and a pressure field as the
forcing term. The result is the ability to predict and understand the rapid and slow
transients of bubble displacement, which is proportional to the average acoustic ra-
diation force. The periodic attractor of the Raleigh-Plesset equation serves as basis
for an optimal acoustic forcing designed to achieve maximized bubble translation
over one dimensionless period. At moderate acoustic intensity, a maximized radial
variance leads to displacement many times larger than the case of purely sinusoidal
forcing. Shape stability issues are considered. Together, these results suggest new
ways to predict some of the direct and indirect effects of the acoustic radiation force
in biomedical applications: e.g., targeted drug delivery and bubble accumulation.

Jean Toilliez
Mech. Eng., Univ. of California, Berkeley

Date submitted: 06 Aug 2007
Electronic form version 1.4