Effects of the finite thickness on the Rayleigh-Taylor instability in elastic solid slabs

S. A. PIRIZ[1], A. R. PIRIZ [2] and N. A. TAHIR [3]

[1)] *Instituto de Investigaciones Energéticas (INEI), E.T.S.I.I., and CYTEMA, Universidad de Castilla-La Mancha, 13071 Ciudad Real, Spain*

E-mail: SofiaAyelen.Piriz@uclm.es

[2)] *Instituto de Investigaciones Energéticas (INEI), E.T.S.I.I., and CYTEMA, Universidad de Castilla-La Mancha, 13071 Ciudad Real, Spain*

[3)] *GSI Helmholtzzentrum für Schwerionenforschung Darmstadt, Planckstrasse 1, 64291 Darmstadt, Germany*

A physical model has been developed for the linear Rayleigh-Taylor instability of a finite thickness elastic slab that lays on the top a semi-infinite ideal fluid. The model includes the non-ideal effects of elasticity as boundary conditions at the top and bottom interfaces of the slab, and takes also into account the finite transit time of the elastic waves across the slab thickness. For Atwood number $A_T = 1$ the asymptotic growth rate is found to be in excellent agreement with the exact solution by Plohr and Sharp [1], and a physical explanation is given for the reduction of the stabilizing effectiveness of the elasticity for the thinner slabs. The feed-through factor is also calculated.

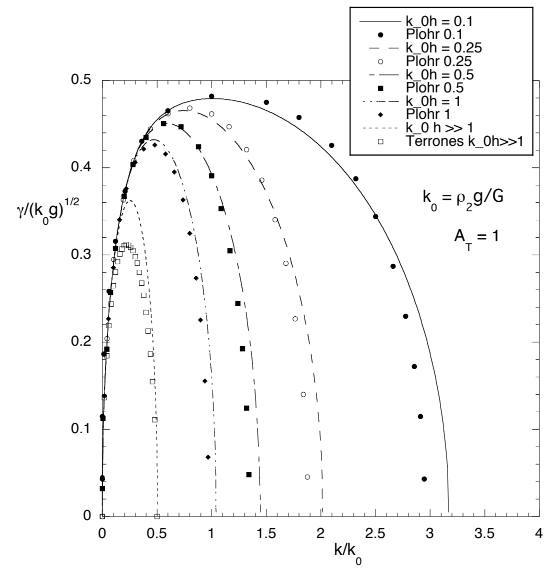

Figure 1: Asymptotic dimensionless growth rate $\sigma = \gamma / \sqrt{k_0 g}$ as a function of the dimensionless wave number $\kappa = k/k_0$ for several values of $a = k_0 h$, and AT =1. Dots for $a \leq 1$are calculated with the theory of Ref.[1], and for $a \gg 1$ Ref.[2] has been used.

References

[1] B. J. Plohr and D. H. Sharp, Z. angew. Math. Phys. **49**, 786 (1998)],

[2] G. Terrones, Phys. Rev. E **71**, 036306 (2005).