ABSORBING BOUNDARIES OF ELLIPTICAL SHAPE FOR TWO-DIMENSIONAL TIME- AND FREQUENCY-DOMAIN ANALYSIS OF ACOUSTIC PROBLEMS

S. Lee[a] and **L. F. Kallivokas**[b]

[a]Department of Civil Engineering
The University of Texas at Austin
Austin, Texas 78712

[b]Department of Civil Engineering
1 University Station, C1748
The University of Texas at Austin
Austin, Texas 78712
loukas@mail.utexas.edu

In this paper we discuss the performance of a family of arbitrarily shaped convex absorbing boundaries for acoustic scattering and radiation problems in unbounded domains [1]. In particular we focus on second- and third-order conditions (local and weakly-non-local) imposed on elliptically shaped boundaries and compare their accuracy and computational efficiency against same-order conditions prescribed on circular boundaries [2]. We show that, in the context of Galerkin-type numerical schemes, the second- and third-order elliptical boundaries are tantamount to time-invariant stiffness, damping, and mass matrices, and can thus be readily used in both the frequency- and time-domains. The latter, coupled with the gains realized by the reduced computational domain afforded by the elliptical boundaries (as much as 80% gain over circular domains [3]), allows for the efficient solution of scalar wave problems in unbounded domains (Fig. 1).

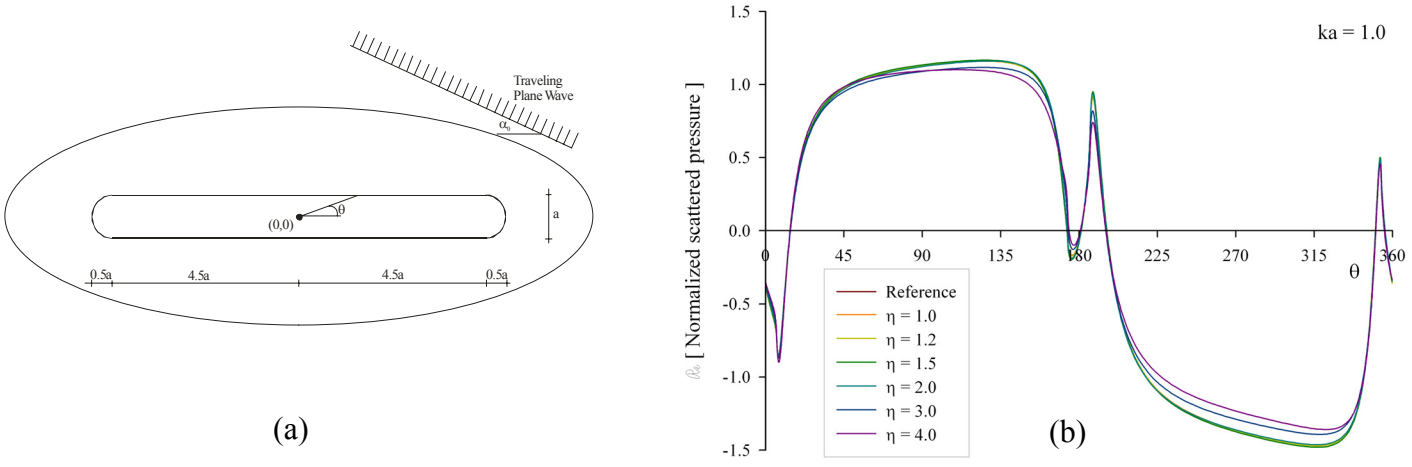

Figure 1: (a) Elongated scatterer insonified by a plane wave; (b) on-surface scattered pressure trace.

References

[1] L.F. Kallivokas, J. Bielak and R.C. MacCamy, "Symmetric local absorbing boundaries in time and space," ASCE *Journal of Engineering Mechanics*, 117(9), pp. 2027-2048, 1991

[2] S. Lee and L.F. Kallivokas, "A new class of two-dimensional absorbing boundaries of elliptical shape for the scalar wave equation," in *Proceedings of the 4th GRACM Congress on Computational Mechanics (distributed on CD-ROM)*, Patras, Greece, June 2002

[3] L.F. Kallivokas and S. Lee, "Local high-order absorbing boundaries of elliptical shape for scalar waves," *Computer Methods in Applied Mechanics and Engineering* (submitted), 2003