Estimating Acoustic Performance of a Cell Phone Speaker Using Abaqus

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Abstract: Consumers demand smaller electronics devices with more features and capabilities. Making devices smaller provides challenges to engineers to maintain the acoustic performances as enclosed acoustic volume sizes are reduced. This paper discusses the requirements for coupled structural-acoustic simulation and demonstrates the application of this technology to cell-phone acoustic design. Due to the smaller volume sizes, the low frequency response of the cell phone is affected. The frequency response rolls off faster at low frequencies when smaller microphone back volumes are used. The present work deals with studying this effect on a simple cell phone model with the finite element package, Abaqus. The results from the simulation can be used in better designing cell phone cavities for optimum performance.

Keywords: Diaphragm, Acoustics, Impedance Boundary, Topology, Merge/Cut, Tie, Back Volume

1. Introduction

Cell phone industry has been making great advances in terms of packing more features while reducing the size of the instrument itself. As the size reduces, it presents more challenges to the overall acoustic performance of the cell phone. At low frequencies, the acoustic pressure emitted by a cell phone device is affected by the size of the back volume which in turn is affected by the size of the instrument. Hence, in order to improve the acoustic performance cell phone designers often use more than one speaker. Additionally, the size of the back volume that would give the optimum acoustic performance has to be prototyped and developed. Fortunately the availability of finite element software codes, such as Abaqus, avoids the time consuming and expensive process of building and rebuilding of back volumes to physically test the optimum performance.