# Research on a Numerical Simulation Method About Harmonic Distortion of Loudspeaker

X. Lu[1]

[1]Zhejiang Electro-Acoustic R&D Center, CAS, Zhejiang, China

## Abstract

The distortion in loudspeaker is a major concern in the Electro - Acoustic industry, especially the harmonic distortion, which is one of the dominant factors that influence the quality of reproduced sound.
A new technique for simulating nonlinear harmonic distortion in transducers based on COMSOL Multiphysics® using finite element analysis(FEM) is proposed, which incorporates the electromagnetic field, the structure and the resulting exterior acoustic field that are all full coupled. The moving mesh method and automatic remeshing method are applied to ensure the proper continuity of force factor Bl(x) and other variables. Structural damping is defined in order to obtain a realistic response. Coil current I(t)、Lorentz force F(t)、displacement x(t) and sound pressure P(t) would be calculated by modeling the transient acoustic field with loading a continuous log-sweep voltage signal, Fig 1 shows the displacement x(t) of coil, Fig 2 shows the sound pressure P(t) at 0.1 m on the loudspeaker axis.
Some type of Order Tracking methods, such as adaptive Vold-Kalman Order Tracking, are used to calculate the magnitude and phase of every harmonic component based on P(t), and finally nth-order harmonic distortion (HDn) and total harmonic distortion (THD) could be got.

# Figures used in the abstract

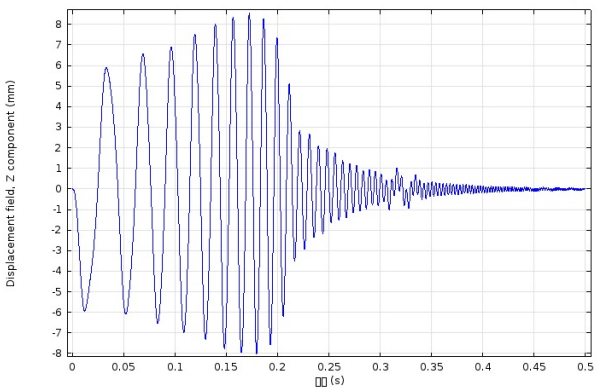


**Figure 1**: Simulation result of displacement of coil.

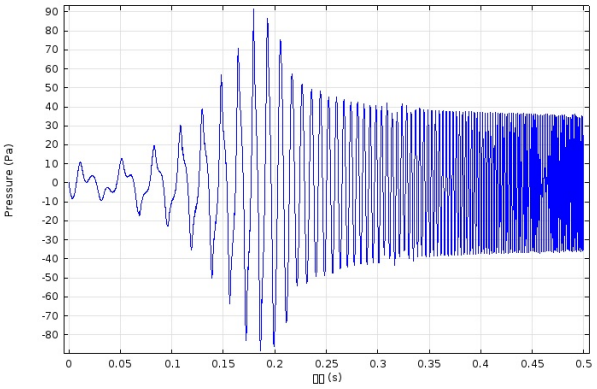


**Figure 2**: Simulation result of sound pressure at 0.1m on the loudspeaker axis.