ROUGH SURFACE CHARACTERIZATION USING ACOUSTIC OPTIMIZATION FRAMEWORK

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ABSTRACT

Characterization of surface properties, such as surface shape [1], or acoustic impedance [2] are relevant in many applications. Previous work has been done for the characterization of the two quantities separately. The present work investigates the characterization of both for a rough surface using a single setup. More specifically, an optimization framework is established to estimate the surface properties by minimizing the difference between the simulated acoustic scattered field and a reference.

The fast multipole indirect boundary element method is employed to model the acoustic surface scattering problem. With the modeling flexibility from the indirect formulation, the target surface can be simplified as a thin sheet, which significantly improves computational efficiency. The surface properties are considered to be approximated by phenomenological models, i.e. a superposition of sinusoidal functions for the surface shape, and a porous material model for the surface impedance. A general-purpose optimizer is coupled with the simulations to minimize the difference between the simulated and reference acoustic field. The numerical examples show that, by using high-quality reference data, the proposed method can retrieve the surface properties for surface shape and surface impedance separately, and also simultaneously.

REFERENCES

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