ID contributo: **173** Tipo: **Presentazione orale**

Advanced vibroacoustic simulations using Isogeometric analysis

giovedì 4 settembre 2025 10:45 (15 minuti)

In this study, we focus on the modeling of vibro-acoustic phenomena [1], employing Isogeometric Analysis (IGA) and projection-based reduced-order models (PROM). The chosen numerical approach relies on the use of Non-Uniform Rational B-Splines (NURBS) to describe not only the geometry but also the unknown displacement and pressure fields, ensuring a more precise and efficient computational framework compared to traditional finite element methods.

The primary objective of this work is to apply the IGA methodology to the study of coupled fluid-structure vibrations, particularly in the context of the automotive field. This type of analysis plays a crucial role in vehicle design, as it enables accurate noise prediction and control, essential for improving passenger comfort and optimizing structural performance. By addressing the computation of elasto-acoustic vibrations, the proposed approach provides valuable insights for reducing unwanted noise in the interior acoustic environment of cars, ultimately leading to better soundproofing strategies and enhanced driving experience.

Furthermore, we introduce a seamless CAD/CAE integration, which eliminates the need for extensive preprocessing steps related to geometry preparation. This streamlined workflow significantly enhances the efficiency of the simulation process, making it more accessible for industrial applications. The combination of IGA and PROM within this integrated framework demonstrates a promising potential for advanced vibroacoustic simulations, offering a robust and accurate tool for engineering design and optimization.

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Classifica Sessioni: Automotive

Classificazione della track: Automotive