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Identification of Dynamic Young's Modulus and Damping of Isotropic Plastic Materials

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Sound quality plays a significant role for many applications. Therefore the acoustical behaviour becomes a major task in the design phase of new products. Especially the acoustical radiation of structural vibrations has to be reproduced accurately by simulations. For this purpose a linear Finite Element Analysis (FEA) is performed, usually with constant material properties. But concerning isotropic plastics the Young's Modulus and damping are highly frequency and temperature dependent. Conventional measurement devices provide parameters which are not accurate enough to get useable FEA simulation results.

This paper shows a new approach to determine the frequency and temperature dependent Young's Modulus and damping of isotropic plastics. With a special test device, a probe is excited by a constant, reactionless, repeatable force when measuring the surface velocity. The modal parameters response-frequency and damping are extracted from these measurements. With the assistance of FEA simulations the Young's Modulus can be iteratively adapted to these modal parameters as a function of frequency and temperature.

Finally a frequency and temperature dependent material database is available where the acoustic radiation of plastic can be easily and accurately calculated, or even be used to do an acoustical benchmark of different materials in the design phase.

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