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Ghost Frequency Noise Reduction through Displacement Deviation Analysis

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Abstract : Low gear noise is an important sound quality feature in modern passenger cars. Annoying gear noise from the gearbox is influenced by the gear design, gearbox shaft layout, manufacturing deviations in the components, assembly errors and the mounting arrangement of the complete gearbox. Geometrical deviations in the form of profile and lead errors are often present on the flanks of the inspected gears. Ghost frequencies of a gear are very challenging to identify in standard gear measurement and analysis process due to small wavelengths involved. In this paper, gear whine noise occurring at non-integral multiples of gear mesh frequency of passenger car gearbox is investigated and the root cause is identified using the displacement deviation analysis (DDA) method. DDA method is applied to identify ghost frequency excitations on the flanks of gears arising out of generation grinding. Frequency identified through DDA correlated with the frequency of vibration and noise on the end-of-line machine as well as vehicle level measurements. With the application of DDA method along with standard lead profile measurement, gears with ghost frequency geometry deviations were identified on the production line to eliminate defective parts and thereby eliminate ghost frequency noise from a vehicle. Further, displacement deviation analysis can be used in conjunction with the manufacturing process simulation to arrive at suitable countermeasures for arresting the ghost frequency.

Keywords : displacement deviation analysis, gear whine, ghost frequency, sound quality
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