

Evaluation of the Power Generation Effect Obtained by Inserting a Piezoelectric Sheet in the Backlash Clearance of a Circular Arc Helical Gear

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Abstract : Power generation effect, obtained by inserting a piezo- electric sheet in the backlash clearance of a circular arc helical gear, is evaluated. Such type of screw gear is preferred since, in comparison with the involute tooth profile, the circular arc profile leads to reduced stress-concentration effects, and improved life of the piezoelectric film. Firstly, geometry of the circular arc helical gear, and properties of the piezoelectric sheet are presented. Then, description of the test-rig, consisted of a right-hand thread gear meshing with a left-hand thread gear, and the voltage measurement procedure are given. After creating the tridimensional (3D) model of the meshing gears in SolidWorks, they are 3D-printed in acrylonitrile butadiene styrene (ABS) resin. Variation of the generated voltage versus time, during a meshing cycle of the circular arc helical gear, is measured for various values of the center distance. Then, the change of the maximal, minimal, and peak-to-peak voltage versus the center distance is illustrated. Optimal center distance of the gear, to achieve voltage maximization, is found and its significance is discussed. Such results prove that the contact pressure of the meshing gears can be measured, and also, the electrical power can be generated by employing the proposed technique.

Keywords : circular arc helical gear, contact problem, optimal center distance, piezoelectric sheet, power generation

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