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Non-contacting Measurement of Oil Film Thickness Between Loaded Metallic Gear Teeth DANIEL B. COX, STEVEN L. CECCIO, DAVID R. DOWLING, Mechanical Engineering, University of Michigan, Ann Arbor MI, 48109 — The mechanical power transmission efficiency of gears is depends on the lubrication condition between gear teeth. While the lubrication levels can be generally predicted, an effective in-situ non-contacting measurement of oil film thicknesses between loaded metallic gear teeth has proved elusive. This study explores a novel oil film thickness measurement technique based on optical fluence, the light energy transmitted between loaded gear teeth. A gear testing apparatus that allowed independent control of gear rotation rate, load torque, and oil flow was designed and built. Film thickness measurements made with 5-inch-pitch-diameter 60-tooth spur gears ranged from 0.3 to 10.2 mil. These results are compared with film thickness measurements made in an earlier investigation (MacConochie and Cameron, 1960), as well as with predictions from two film thickness models: a simple two-dimensional squeezed oil film and the industry-accepted model as described by the American Gear Manufacturers Association (AGMA 925, 2003). In each case, the measured film thicknesses were larger than the predicted thicknesses, though these discrepancies might be attributed to the specifics the experiments and to challenges associated with calibrating the fluence measurements. [Sponsored by General Electric]

David R. Dowling
Mechanical Engineering, University of Michigan, Ann Arbor MI, 48109

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