

# Real-Time Prediction Of Incipient Failure In Working Fluids

R. W. Pryor, Ph.D.<sup>1</sup>

<sup>1</sup>Pryor Knowledge Systems, Inc., Bloomfield Hills, MI, USA

## Abstract

Working fluids (engine oil, transmission fluid, hydraulic fluid, coolants, etc.) become contaminated in use. To ensure that the equipment is not damaged by the contaminated fluid, the fluid is typically removed and replaced periodically. For large groups of machines, the used fluid is then shipped to an analysis laboratory and a complicated analysis is performed to ensure that the fluid replacement period is correct for each machine and that each machine is not in need of immediate repair. This procedure is costly, time consuming, and does not always work in a timely manner to prevent machine failure.

This paper presents a new approach to working fluid analysis. The model presented herein demonstrates the value of real-time analysis of the differential electrical admittance of the working fluid in-situ to detect the incipient failure of the working fluid. Once the incipient failure has been detected, the contaminated working fluid can be removed and replaced with new, high quality working fluid, before the machine is damaged.

The model presented in this paper employs COMSOL Multiphysics® and the AC/DC Module. This model is derived from a COMSOL® model, Frequency Domain Modeling of a Capacitor. In this case, the model is developed to show how the differential electrical admittance changes in the frequency domain, as a function of the shift in the parametric value of the electrical conductivity and/or the relative permittivity.

## Figures used in the abstract

□

**Figure 1** : Engine Oil Admittance vs. Frequency