RESEARCH:

WaterNILM: Nonintrusive Load Monitor for Water, Oil, and Gas

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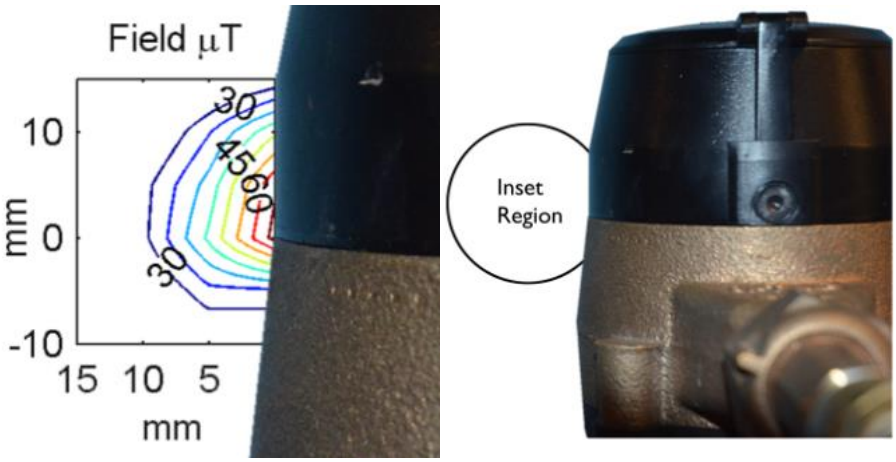

Nonintrusive Water Flow Detection using Magnetic Fields

This project has focused on developing technologies that would support "creating" water by eliminating loss and waste without intrusive hardware installation and without invasive changes to system users. Specifically, during the project period, we have demonstrated three technologies: First, we have developed new circuits and signal processing algorithms for evaluating flow in both utilities and also process flow components. These techniques exploit new tunnelling magneto-resistive materials (TMR) for detecting very small magnetic fields, and also exploit MEMS vibration sensors to create a combined set of sensor data streams that provide fine-grain information about liquid flow in pipes. Second, we have developed a sensitive technique for estimating shaft torque and speed without mechanical sensors for motors like pumps. The techniques developed during this project permit the estimation of pump behavior nonintrusively, strictly from electrical measurements. Third, we have developed emulation models to capture the potential relative dynamics of pump operation and water flow.