

Consulting-Specifying Engineer

Specifier's Notebook

Best Defense Against EMI: Proven Materials...and Software

By RICHARD E. LOYD

The industry's shift from mechanical relays and dc and ac belt or gear-reduction drives to ac variable-frequency drives and solid-state controls has left engineers facing growing problems with electromagnetic interferences (EMI) and power quality. With sensitive computer equipment in office and industrial settings, it has become more important than ever for engineers to deal with EMI.

While visible occurrences, such as flickering or wavy images on computer monitors, certainly impact occupant productivity and health, the potential corruption of electronic and communications data is also very concerning.

New EMI, research

To address these problems, Dr. A. P. Sakis Meliopoulos at the Georgia Institute of Technology, Atlanta—under sponsorship of the Steel Tube Institute of North America—has been conducting in-depth research on electromagnetic fields, specifically, how to reduce their effect on electrical and electronic equipment. The results, combined with earlier Georgia Tech studies on grounding, have been developed into a new software program called GEMI, for "Grounding and Electromagnetic Interference Analysis," which offers factual data and tools for calculating actual designs.

EMI software capabilities

• **Mode 1** of the software enables the user to quickly calculate and size equipment grounding conductors using steel rigid conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT), copper conductors or aluminum conductors.

• **Mode 2** helps engineers calculate the magnetic field intensity in milli-Gauss around power circuits for effective conduit design.

• Additionally, the software can analyze new or existing wiring installations from a single branch circuit to the entire electrical system where linear and nonlinear loads are present. The EMF research shows that steel is the most effective shield for 60-hertz (Hz) electromagnetic fields. In particular, rigid steel conduit, IMC and EMT have been proven to reduce these fields by as much as 90 percent. Aluminum conduit reduces such fields by about 5 percent, while non-metallic materials are characterized as being equivalent to conductors in free air.

Shielding these fields at the design and build stages is the most cost-effective approach to controlling the impact of EMI, says Meliopoulos, who got involved in the research when an EMI problem arose at the nearby facility. A row of computer stations installed in a workplace were experiencing serious interference. Extensive investigation revealed that the culprit causing distortion on the monitors was electrical wiring in a rack of aluminum conduit running parallel to the computer stations directly under the floor. Unfortunately, neither the conduit nor the office equipment could be moved.

Meliopoulos recommended that the steel plating be installed above the conduit to separate the power conductors from the sensitive equipment. While this solved the EMI problem, the price was quite steep. Engineers and designers often face the dilemma of having to balance appropriate

products or construction methods with client concerns over installed costs. While steel conduit may not be the least expensive wiring method available, its proven effectiveness as a shield against magnetic forces can make its life-cycle cost a relative bargain.

The GEMI software gives engineers a factual basis for the cost of EMI, demonstrating to building developers the justification for higher up-front costs.

Recent case studies demonstrate the benefits of the new software tools and specifying steel for EMI shielding. One engineering firm has based their decision to use steel on the results of the GEMI study. A consultant for the Federal Aviation Administration (FAA) has recommended the use of steel conduit to overcome problems at locations where control, communications and airfield-lighting cable either cross or run parallel to each other.

FAA officials were delighted to learn that research was available to prove what was instinctively believed: That steel conduit effectively shields against magnetic forces. The GEMI software provides a way to document and prove solutions to EMI problems. It also eliminates a lot of the crunch work. The designer can even grab a cup of coffee while the computer does the work!

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- EMI Design Software Options*
- Calculate and size equipment grounding conductors (steel conduit, IMC, EMT, copper)
 - Calculate magnetic field intensity at power circuits
 - Analysis of new or existing wiring installations with linear and non-linear loads

GEMI software and the Georgia Tech report are available from the Steel Tube Institute of North America, 2000 Ponce de Leon, Suite 600, Coral Gables, FL 33134. Tel: (305) 421-6326, E-mail: STINA@steeltubeinstitute.org