



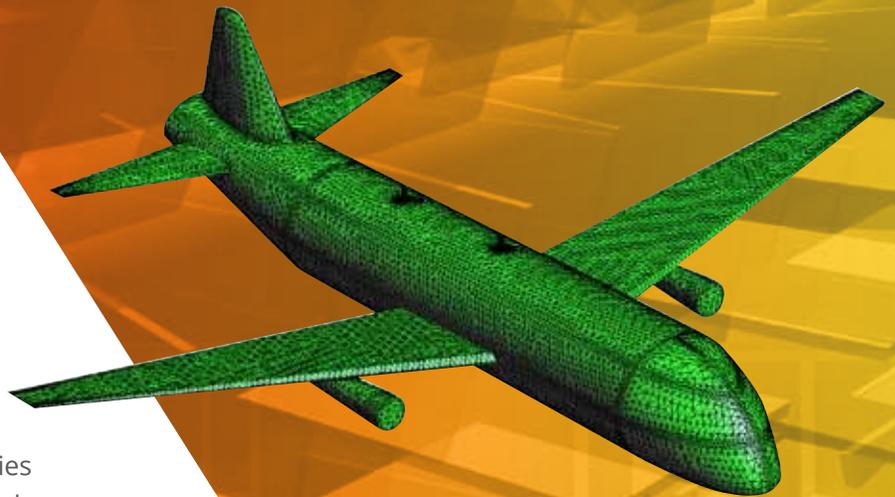
VIRTUALEM

Ready for a Challenge

At Virtual EM,

we relish the challenge to solve difficult problems with scientifically-sound, reliable, innovative solutions. Our solutions enable our partners and clients to make ground-breaking advancements in computational electromagnetics, embedded wireless sensors, conformal antennas, and machine learning.

Founded in 2002 by engineers who hungered to solve the most complex problems, Virtual EM creates new technologies for the defense and civilian markets. We also have an excellent track record for creating products and licensing technologies.



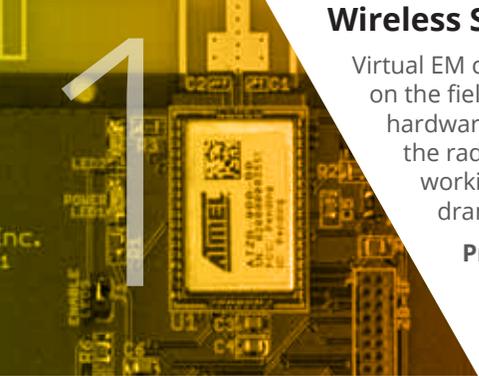
- ▶ **Trusted.** We listen to your challenges, then provide candid input on the feasibility of project aims, keeping your best interests in mind. Our customers rely on our input and trust our guidance to successfully accomplish their goals.
- ▶ **Flexible.** As a small research and development firm, we can flex our size as needed. We bring together academics, researchers, and commercial partners to create a team perfectly suited to tackle your challenge. Our flexibility can also help modify solutions to be more applicable for commercial markets.
- ▶ **Reliable.** We deliver what is promised on time and on budget. You can be confident that our budgets and timelines are realistic.

Let Virtual EM be your problem-solver when you need a trusted, flexible and reliable partner on tough research challenges. To learn more, contact Virtual EM, Inc. at **734-222-4558** or **sales@virtualem.com**, or find us online at **www.virtualem.com**.

Our Expertise

The Virtual EM team specializes in four technology areas:

Wireless Sensor Networks



Virtual EM creates wireless sensor technologies to enable Internet of Things (IoT) by moving data from sensors on the field to the cloud to mobile devices without degradation of data integrity. Virtual EM focuses on the hardware and firmware that manages the sensor interfaces as well as the wireless connectivity including the radio frequency (RF) front end and the antenna. As a significant enabler of IoT, Virtual EM has been working to develop low-power analog processors to equip sensors with machine learning capabilities to dramatically reduce the data traffic and achieve network scaling.

Products: SenMesh™ is an 802.15.4 (ZigBee) Sensor Node with wireless mesh capability. A portion of this technology, among others, was licensed to AMF Nano Corporation (Ann Arbor, Michigan) in 2015 for gas and content monitoring applications. HybraMesh™ is a hybrid ZigBee/RFID system combining the low-power features of RFID sensing with mesh network capability of the ZigBee.

Computational Electromagnetics

Virtual EM develops software for modeling electromagnetic radiation, scattering and propagation in closed as well as open spaces. State of the art full-wave and asymptotic methods are accelerated on multi-core CPUs and GPUs for faster simulations. Development of a special purpose processor to provide orders of magnitude speed-up compared to the state-of-the-art is continuing.

Products: VirAntenn™ is a computer aided design (CAD) software that predicts the electrical performance of antennas, RF circuits and microwave devices, and radar signature of targets. ViLab™ is a CAD software that predicts the signal levels in urban areas due to multiple transmitters. ViLab™ computational engine is more efficient than typical ray tracing engines and provides 8dB accuracy, which is industry standard.

Antennas and Radio Frequency (RF) Circuits



Whether the need is for zero weight, embedded or conformal antennas, Virtual EM is ready for the challenge. Our antenna designs are optimized for performance to maximize signal-to-noise ratio while minimizing co-site interference. Most of our designs are frequency-tunable and can self-heal to recover most of their functions in case of damage to the antenna structure.

Products: ZeroWeight™ is an antenna design concept (patent pending) customized for the particular platform at hand and adds no weight to the platform. It is the most efficient antenna that could be put on that platform. BeamPick™ is a tunable multi-beam wraparound antenna capable of 360 degree coverage. It was developed under a NASA Phase II contract as a wearable antenna for astronauts to use in extra vehicular activities in space.

Machine Learning



Machine learning has wide-ranging applications from emergency medicine to data mining to military target classification. Virtual EM has developed numerous machine learning algorithms based on Support Vector Machines (SVMs) with support from U.S. Navy for detecting periscopes in high seas and Missile Defense Agency for detecting and identifying missile targets from among decoys. There is an exciting work underway for implementing machine learning at the sensor level using low-power analog processors to dramatically reduce data traffic over the network to enable IoT.



For more information, contact Virtual EM, Inc.,
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