

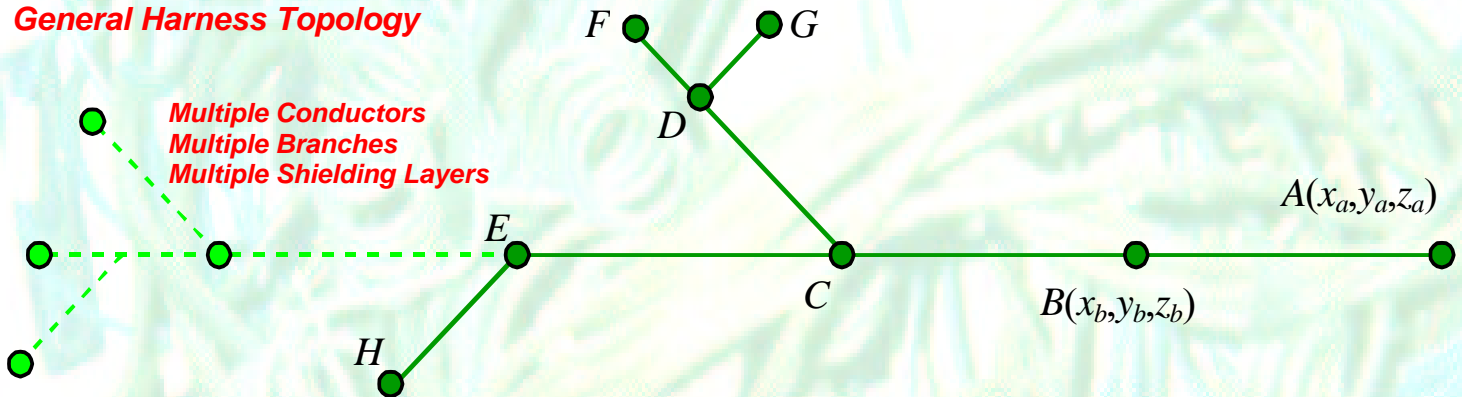
MHARNNESS

Electromagnetic Simulation of Complex Wiring Harnesses

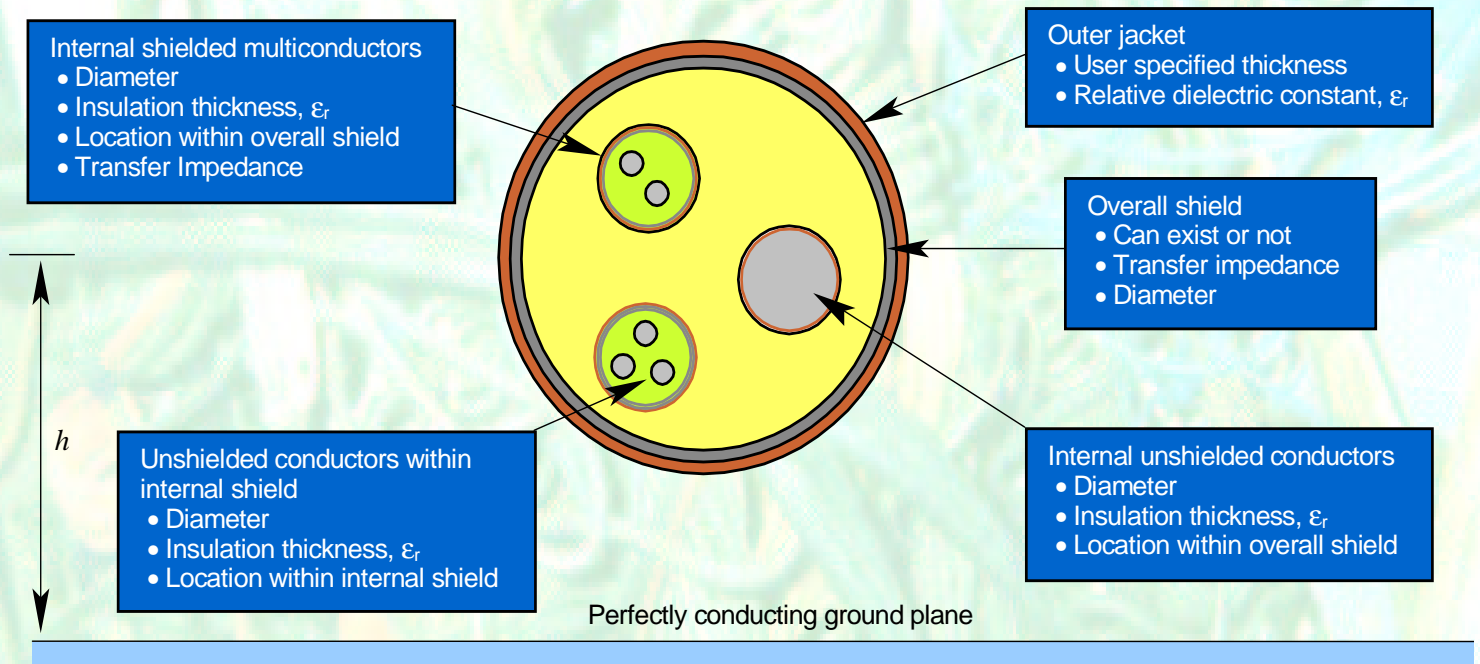
Applications

- EM Field Coupling to Complex Wiring Harnesses
- HIRF (High Intensity Radiated Fields) Evaluation
- Lightning Evaluation
- EMC/EMI Simulation
- MIL-STD-461 RS and CS Simulations
- DO-160 RS and CS Simulations
- Radiated Emissions
- Cross Talk Evaluation
- Signal Propagation
- Shielding and Bonding Studies

General Harness Topology



Each segment can have properties defined in the diagram below.



Terminations

- A variety of passive *RLC* terminations available
- Optional SPICE Interface (UNIX only) allows application of complex non-linear terminating

Sources

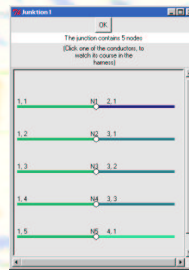
- Plane wave of arbitrary angles of incidence and polarization
- Measured or numerically derived electric fields, bulk currents
- Voltage sources at ends of conductors
- Voltage sources, electric fields, anywhere on any conductor
- Library of user specified waveforms

Notes

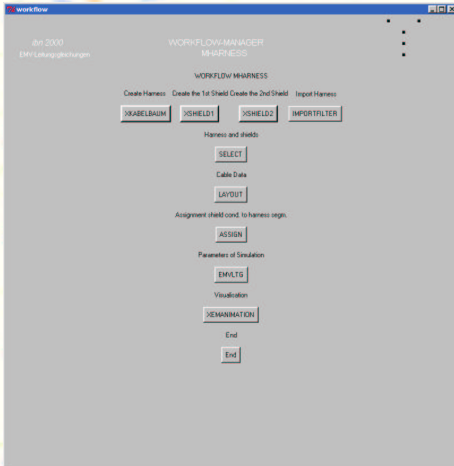
- User specified or MHARNNESS computed **L** and **C** matrices
- Connector transfer impedances can be included.
- Each shield has individually specified transfer impedance
- User specified or MHARNNESS computed transfer impedances
- The number of wires, branches, shields limited only by computer resources
- Computation in time domain; frequency domain information generated by supplied Fourier post processing tools

MHARNESS Graphical User Interface

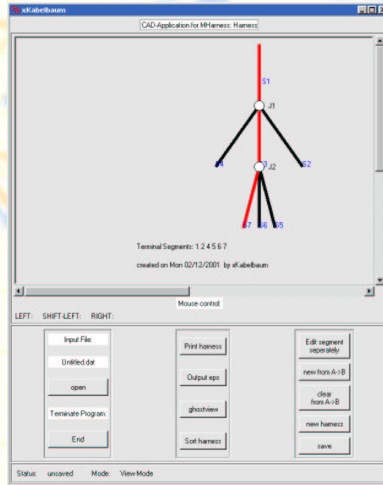
- Provides an organized approach for problem set up and solution
- Interfaces to wire parameter libraries
- Visualization of results



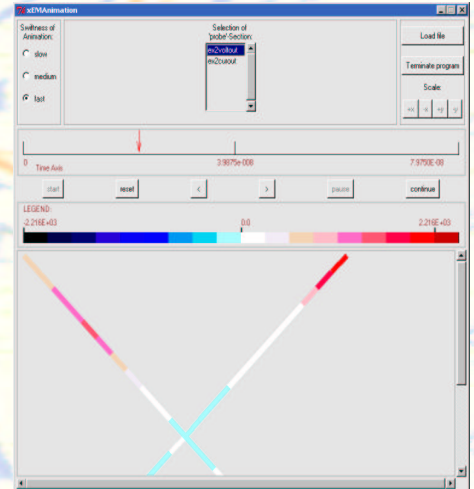
Graphical visualization and editing of wire connectivity at junctions



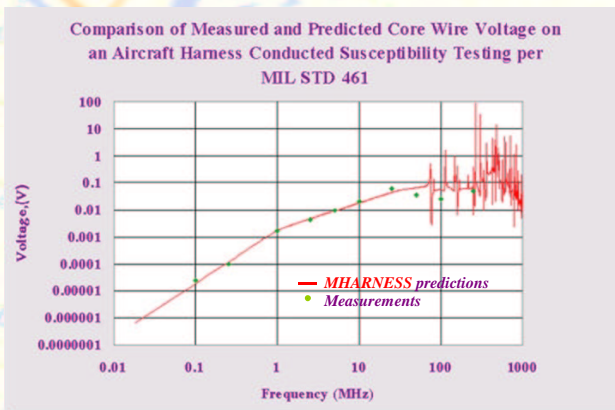
WORKFLOW organizes the process of model building



Rapid creation of harness topology and conductor connectivity

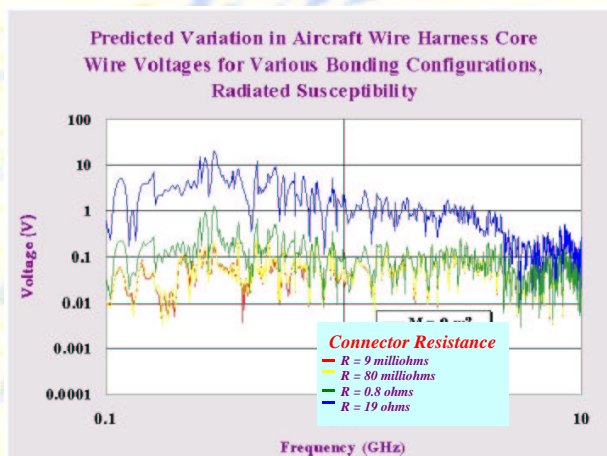


Animation capability visualizes harness voltage or current distributions



A Sample MHARNESS Simulation

The left plot shows a comparison of MIL STD 461 CS measurements with MHARNESS predictions for a flight article engine wire harness having 7 branches, an overall shield, and 12 internal twisted shielded pairs. The lower left plot shows an MHARNESS prediction of core wire voltages on the same harness for various connector bonding impedances, for radiated susceptibility testing



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