DREL
DEPARTMENT OF RADIO ELECTRONICS

Aircraft wiring and transient caused by lighting

ITSS 2014 - 24nd International Traveling Summer School on Microwaves and Lightwaves

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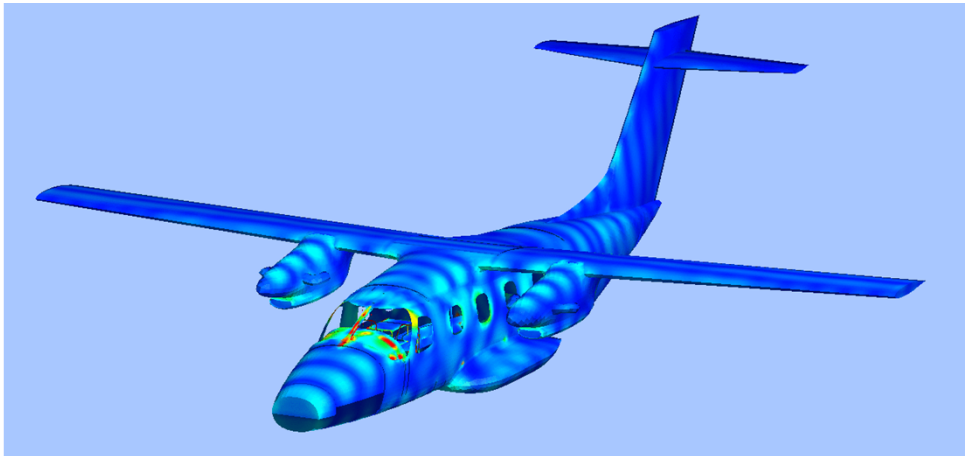
6. - 11.7.2014, Copenhagen

Outline

- Introduction
- Direct effect of lightning
- Indirect effect of lightning
- Modeling
- Simulation
- Results
- Conclusion

Introduction

- Specifics of EM airplane environment
  - HIRF
  - Effects of lightning
    - Direct
    - Indirect



Surface current on 400 MHz

Direct effects of lightning

- Threats
  - Mechanical damage
  - Discharge/sparking
- Aircraft zoning
- Protection
  - Lightning diverter
  - Electrical bridging

Lightning strike damage

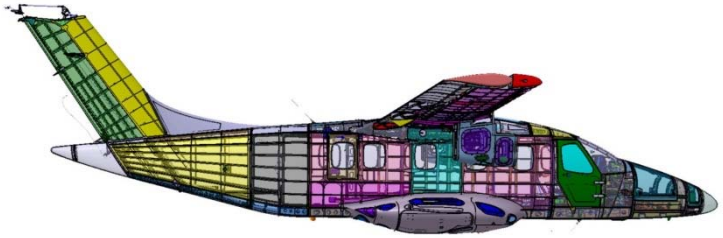
Indirect effects of lightning

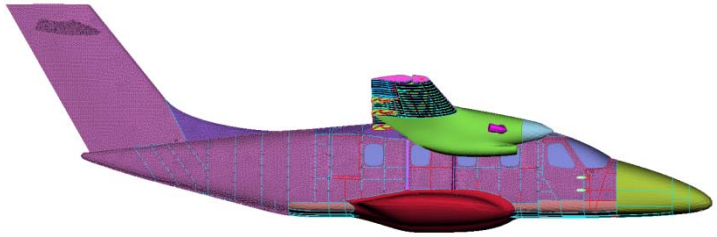
- Threats
  - Electromagnetic induction
- RTCA/DO-160G
- Protection
  - Cable shielding

A lightning strike to A350 WBX

Modeling 1/2

- Geometrical simplification
  - Geometry cleaning
    - Details
    - Small holes
    - Material thickness
  - Other Problems
    - Manufacturing inaccuracy

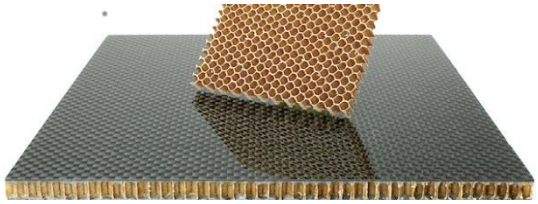


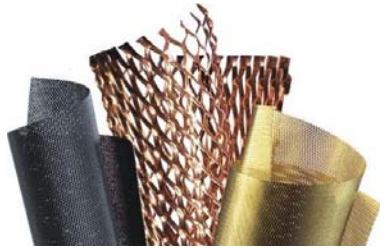


The process of model creating

Modeling 2/2

- Material modeling
  - Material simplification
  - Multi-layer material, composite
  - Analytical models
  - Manufacturing defects

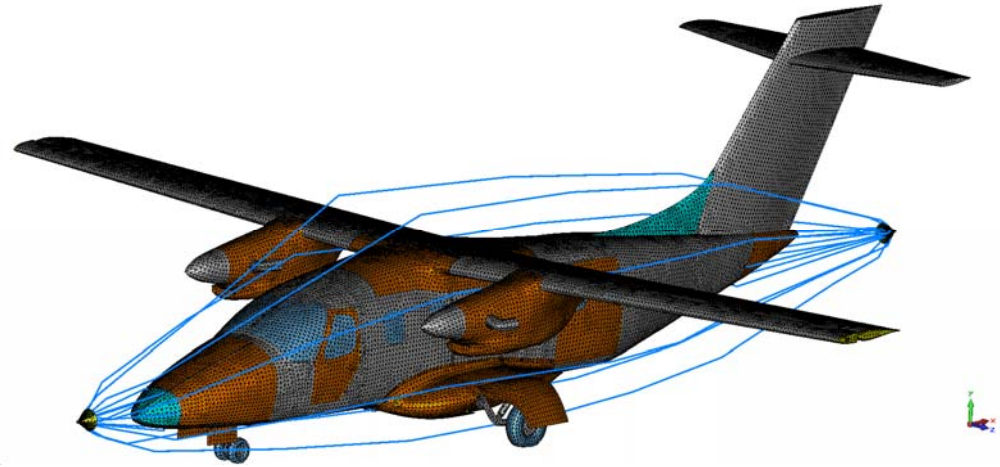




Materials defects on protected composite

Verified method

- Verified results in CST MWS
  - Excitation LLDD
  - Description of material



Excitation LLDD, left measurement, right simulation model

Results

Platform: EV-55
Test point: SC12b
Excitation: Direct Drive

SC sensor orientation:
Along fuselage

Frequency band:
10 KHz – 20 MHz

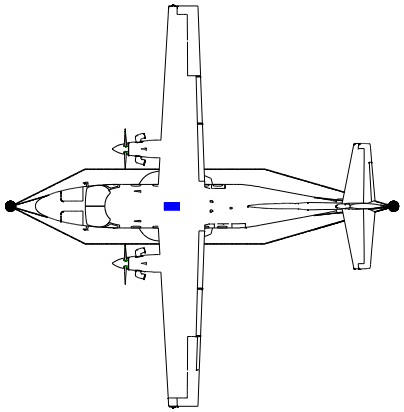


Fig. I: Situation sketch

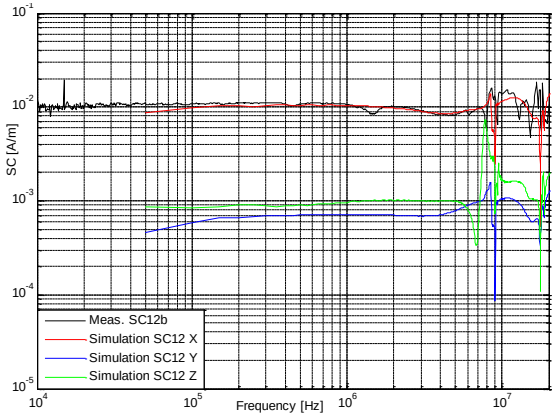


Fig. II: Raw data comparison

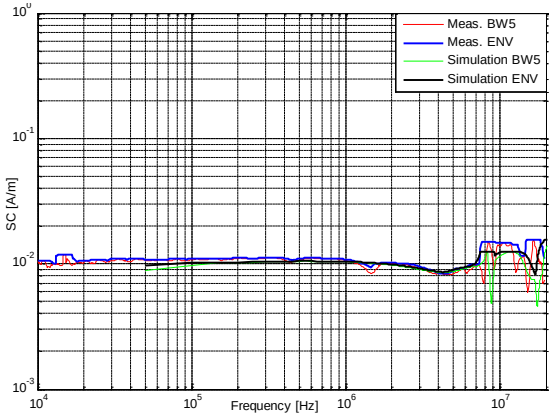


Fig. III: Comparison of BW average and envelope results

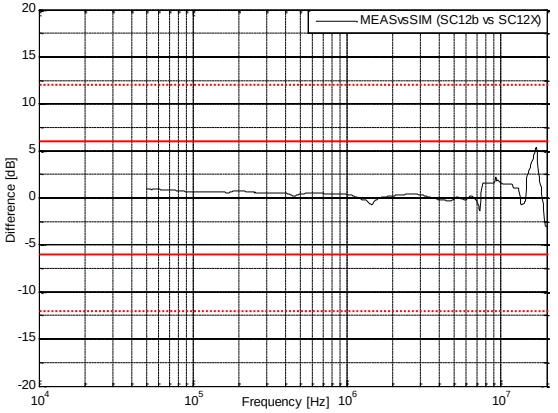


Fig. IV: Difference between measured and simulated envelopes

Conclusion

- Creating of models is time-consuming
- Very good coincidence between the results of measurements and simulations in DD excitation
- Prerequisite for simulation indirect effects of lightning

Thank you for your attention!

This work was supported by Czech Science Foundation under grant no. P102/12/1274. Support of projects CZ.1.07/2.3.00/20.0007 and CZ.1.05/2.1.00/03.0072 is also gratefully acknowledged.

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