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Cables and electromagnetic compatibility into aircraft

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Résumé

Cet écrit veut souligner le problème de la compatibilité éléctromagnetique sur les avions. À cause de la place limitée les conducteurs trop voisins l'un à l'autre dans les câbles interagient pour produir accouplement entre les conducteurs. On va traiter aussi l'interaction entre le système éléctrique et l'éléctricité atmosphérique.

Abstract

The goal of this paper is to outline the problem of electromagnetic compatibility on aircraft. Because of the limited space wires in close proximity in cable bundles interact to produce wire-to-wire coupling.

The paper will also deal with the interaction between the aircraft electric systems and atmospheric electricity.

Because of the limited space on aircraft, wires in close proximity in cable bundles interact to produce wire-to-wire coupling.

Long signal lines interconnecting sensors and control amplifiers are the most common means of coupling interference fields into aircraft and a variety of effects have been observed in electrical generation. The effects of on-board sources, such as electrical generator systems, motors, actuators, de-icers, and circuit breakers are usually most evident in radio frequency receivers, but large inductive transients can cause nuisance trips or shut down of other systems.

The unintended interaction between two or more circuits via electromagnetic fields can cause interference problems (EMI). The following section deals with this phenomenon called crosstalk that is illustrated in fig.1.

Crosstalk phenomena

Each circuit consists of a source connected to a load through a pair of wires, which are parallel and lie in close proximity.

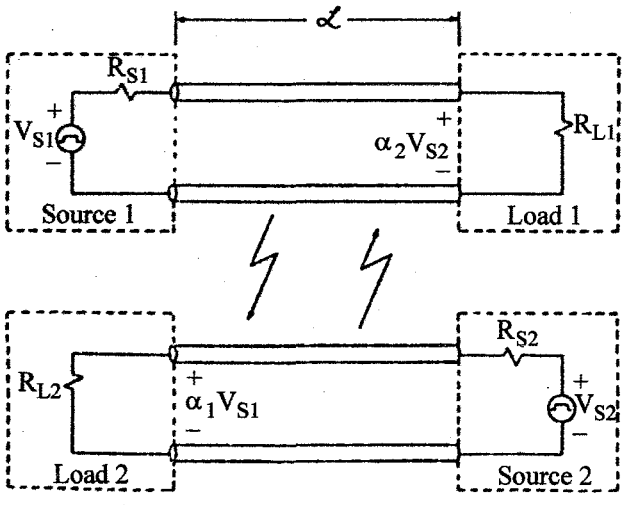

Figure 1 - Illustration of Crosstalk

Currents flowing along these wires create magnetic fields that couple to the other circuit and charges generate electric fields that couple also to the other circuit. These electromagnetic fields induce signals in the two circuits.

Portions of these signals $\alpha_1 V_{S1}$ and $\alpha_2 V_{S2}$ appear at the inputs to each circuit [1].

The task in modelling crosstalk is the prediction of these signals and whether they will cause the respective loads to malfunction in order to use alternative wiring measures to reduce this phenomenon.

If the cross-sectional dimensions of the line are electrically small it can be assumed that the electric and magnetic fields surrounding the conductors satisfy a transverse electromagnetic field structure in that the electric and magnetic fields lie in a plane that is perpendicular to the line axis. We will consider a three-conductor line as a model as shown in Fig.2. It consists of a generator conductor, a receptor conductor, a reference conductor, which are parallel conductors of uniform cross-section along their lengths. We assume that the medium surrounding the wires is lossless and homogeneous.

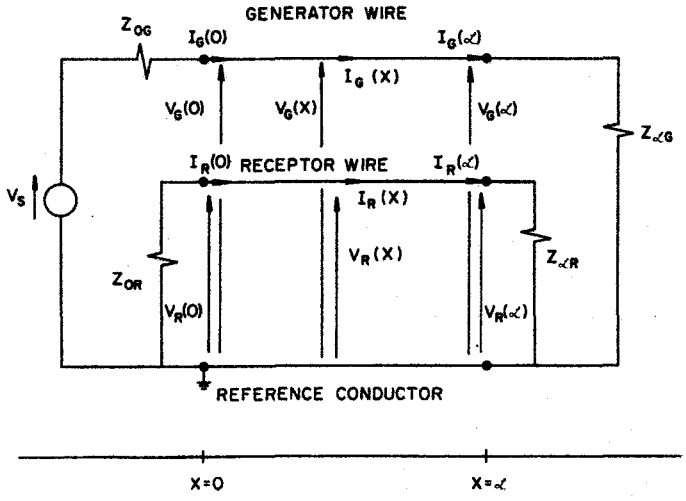

Figure 2