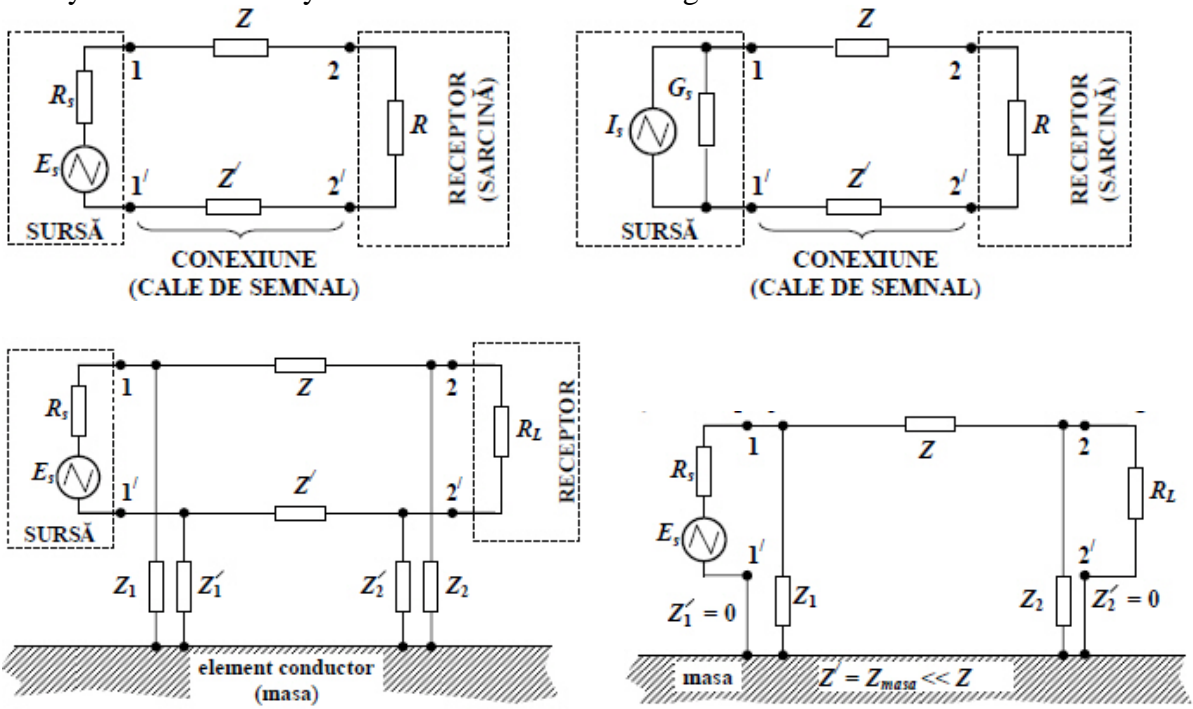


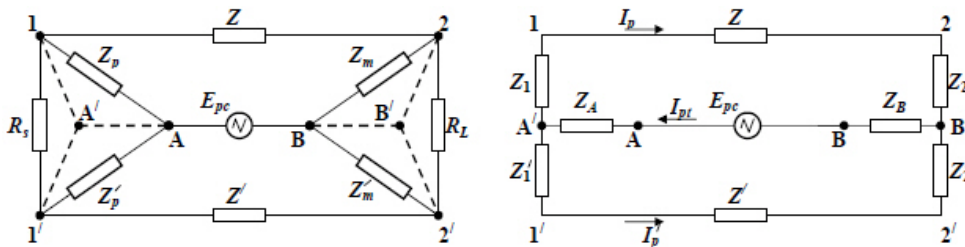
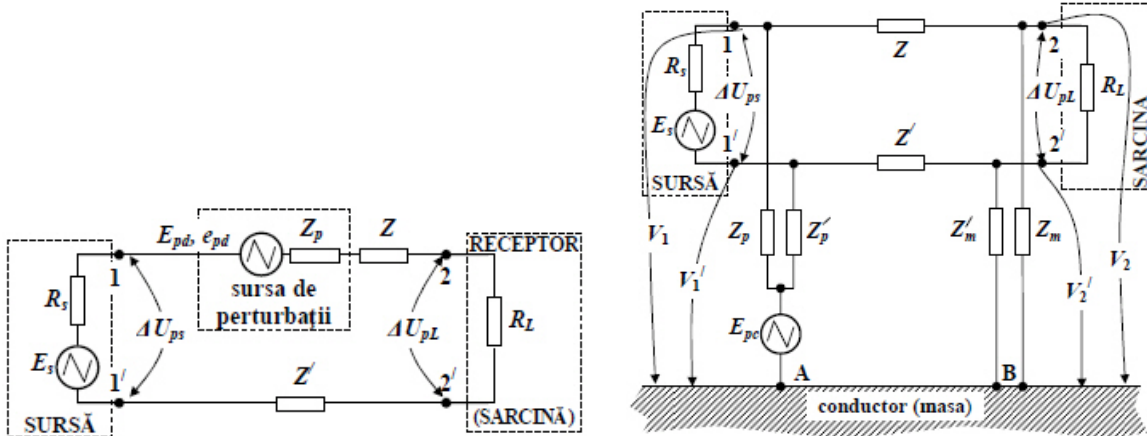
# ELECTROMAGNETIC COMPATIBILITY

## Exam topics

1. . Symmetrical and asymmetrical connections. The ground in electronics.

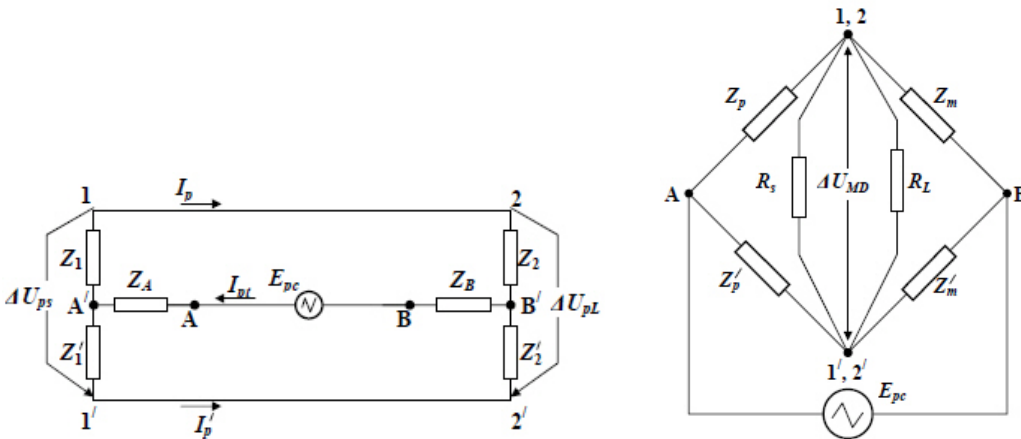


2. . Common mode and differential mode couplings and perturbations. The conversion of common mode perturbations to differential mode. The effects of symmetrization.

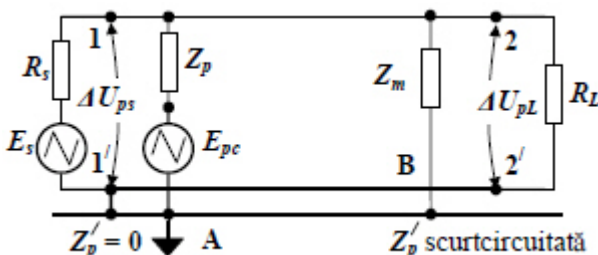


$$\Delta U_{ps} = E_{pc} \frac{Z_p}{Z_T + Z_p} \cdot \frac{Z_1 Z_2' - Z_1' Z_2}{(Z_1 + Z_2) \cdot (Z_1' + Z_2')}$$

$$\Delta U_{pL} = E_{pc} \frac{Z_p}{Z_T + Z_p} \cdot \frac{Z_1' Z_2 - Z_1 Z_2'}{(Z_1 + Z_2) \cdot (Z_1' + Z_2')}$$

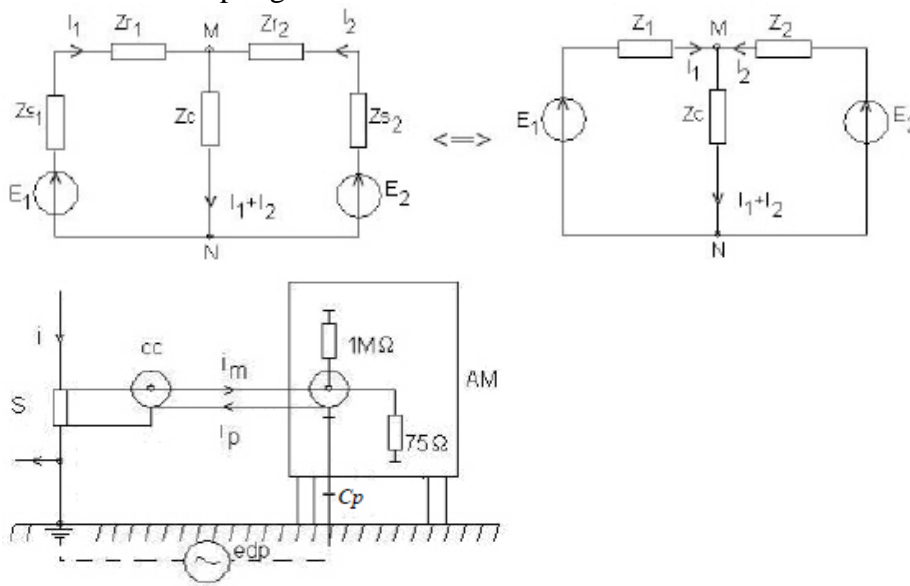


$$CMRR = \frac{E_{pc}}{|\Delta U_{MD}|} = \left| \frac{R(Z_p + Z_m)(Z_p' + Z_m') + Z_p Z_m(Z_p' + Z_m') + Z_p' Z_m'(Z_p + Z_m)}{R(Z_p' Z_m - Z_p Z_m')} \right|$$

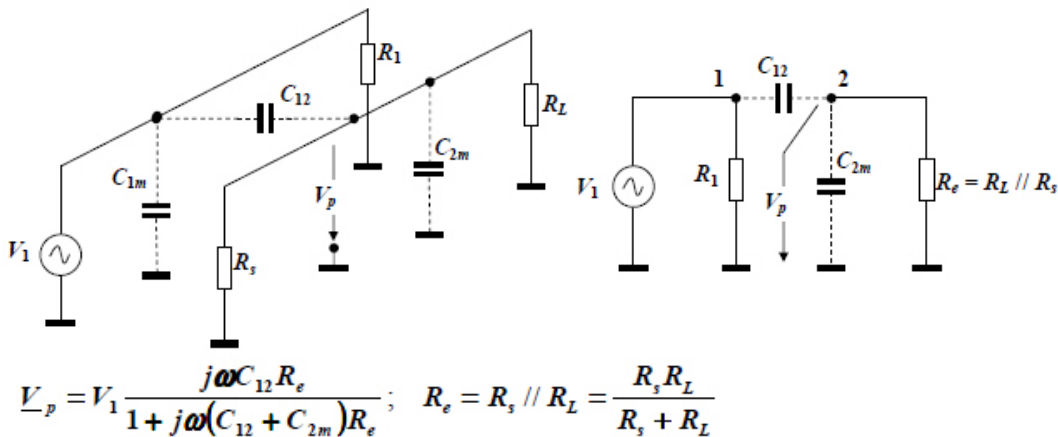


$$CMRR = \left| 1 + \frac{Z_m}{Z_p} + \frac{Z_m}{R} \right|$$

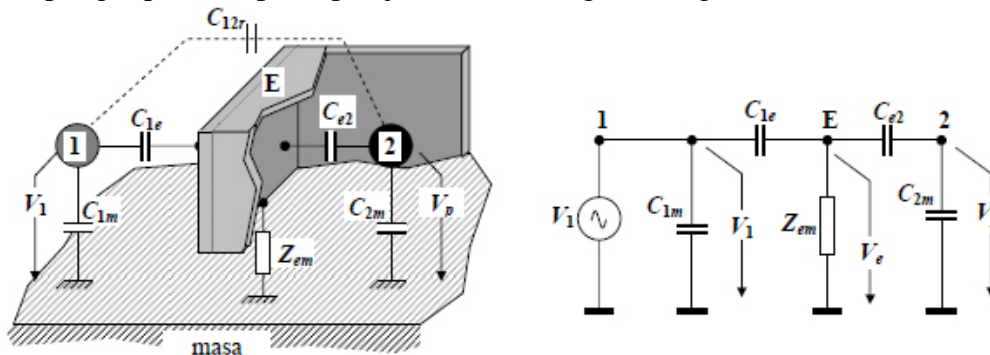
3. Galvanic coupling.



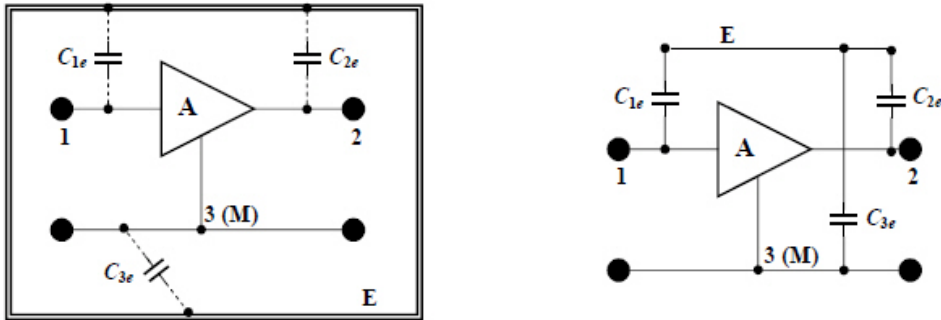
4. Occurrence and effects of the capacitive parasitic coupling. Weak and strong coupling. Coupling reductions measures.



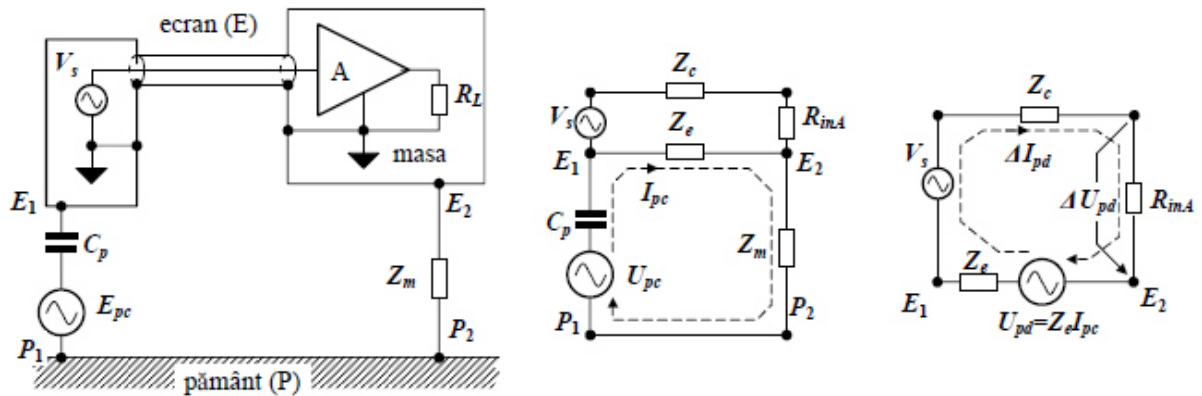
5. Electrical shielding – means of protection against disturbances introduced by capacitive coupling: operation principle, justification of grounding.



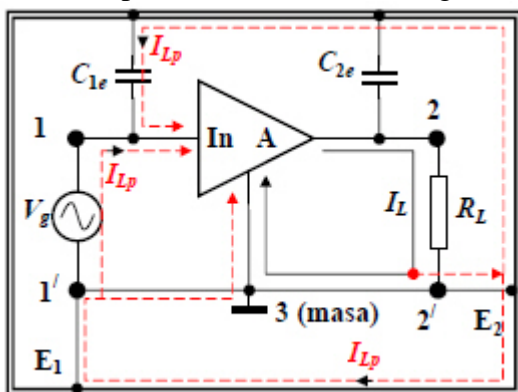
6. . Principles of electrical shields grounding. Rule no. 1.



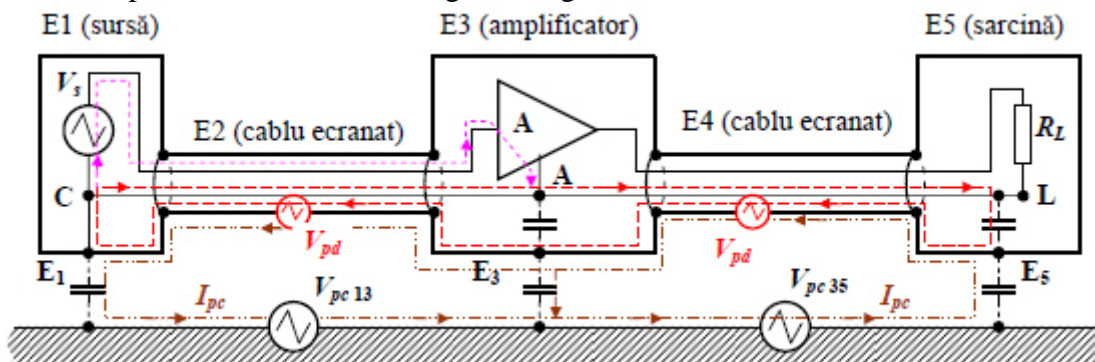
7. . Principles of electrical shields grounding. Rule no. 2.



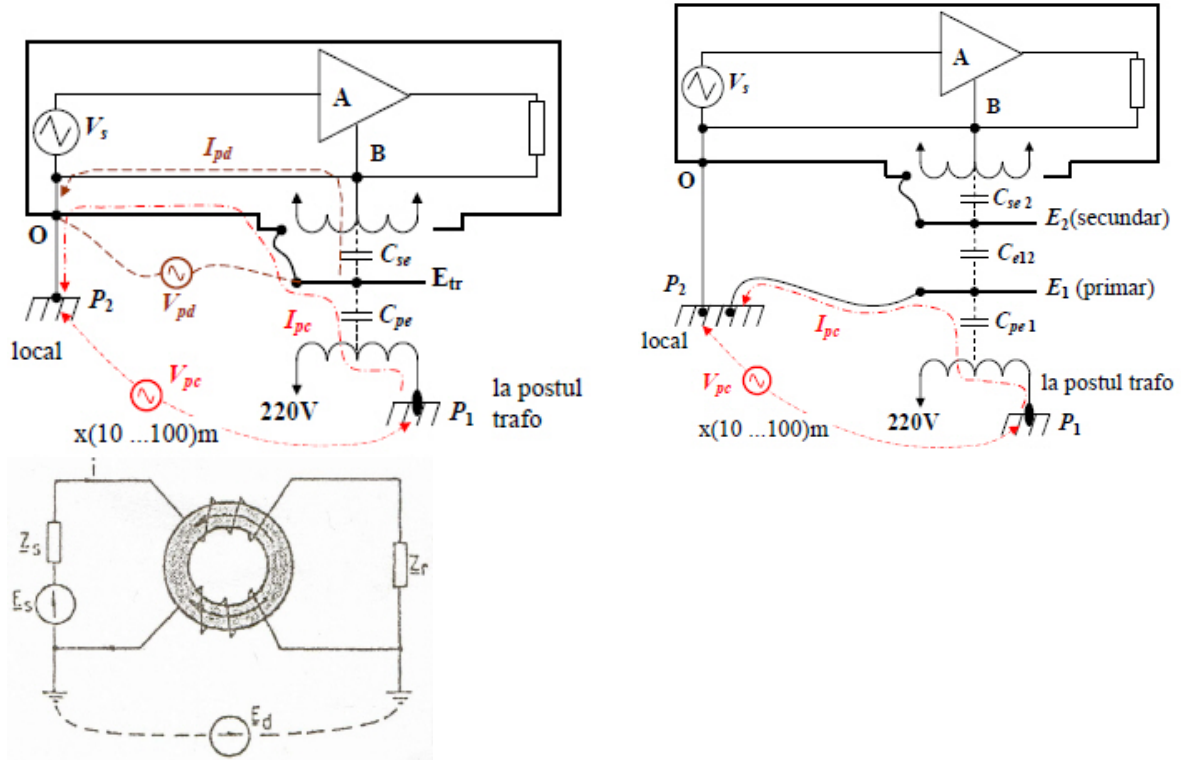
8. . Principles of electrical shields grounding. Rule no. 3.



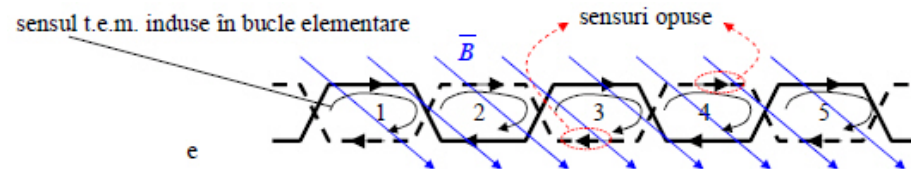
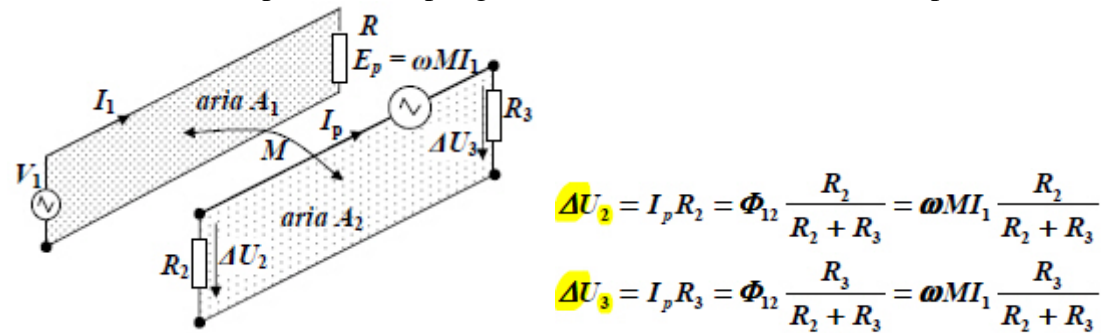
9. . Principles of electrical shields grounding. Rule no. 4.



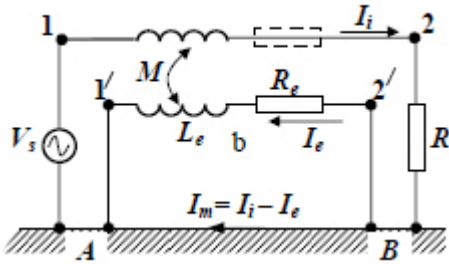
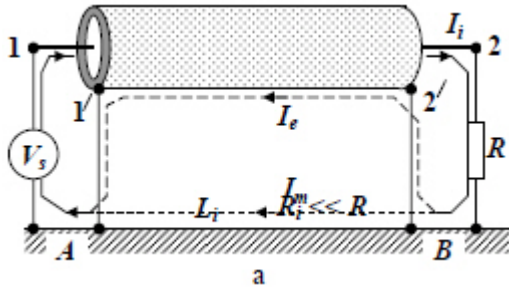
10. . Shielding of the power (supply) transformers.



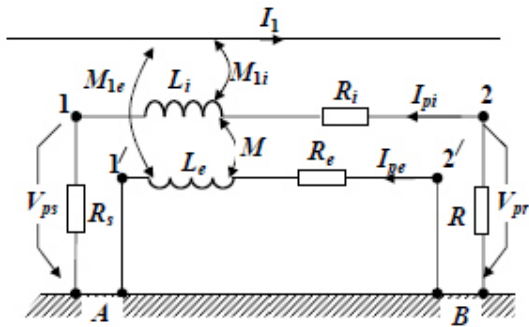
11. . Occurrence and effects of the inductive parasitic coupling. Means for reducing the effects of inductive parasitic coupling. The use of two-wire and twisted-pair cables.



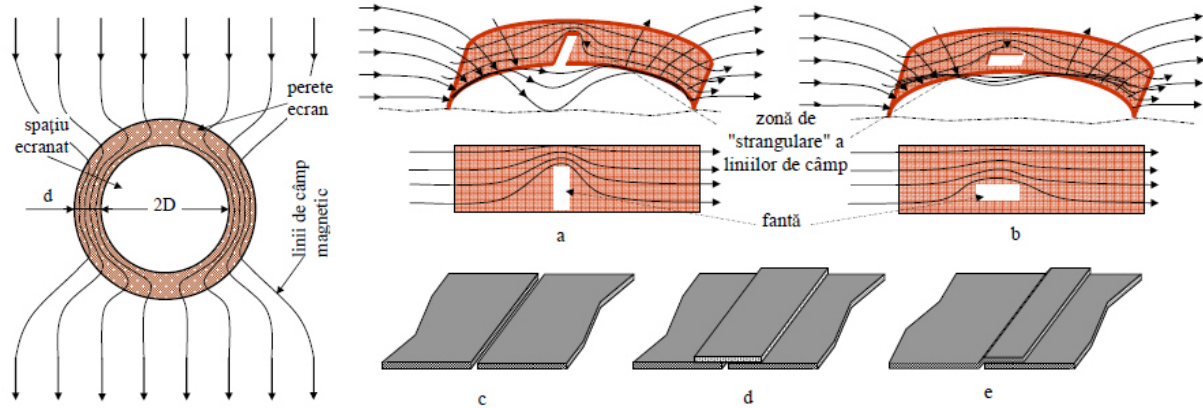
12. . Shielding against the inductive parasitic coupling.



$$\underline{I}_e = I_i \frac{j\omega L_e}{R_e + j\omega L_e} = I_i \frac{\omega}{j\omega + R_e/L_e}$$

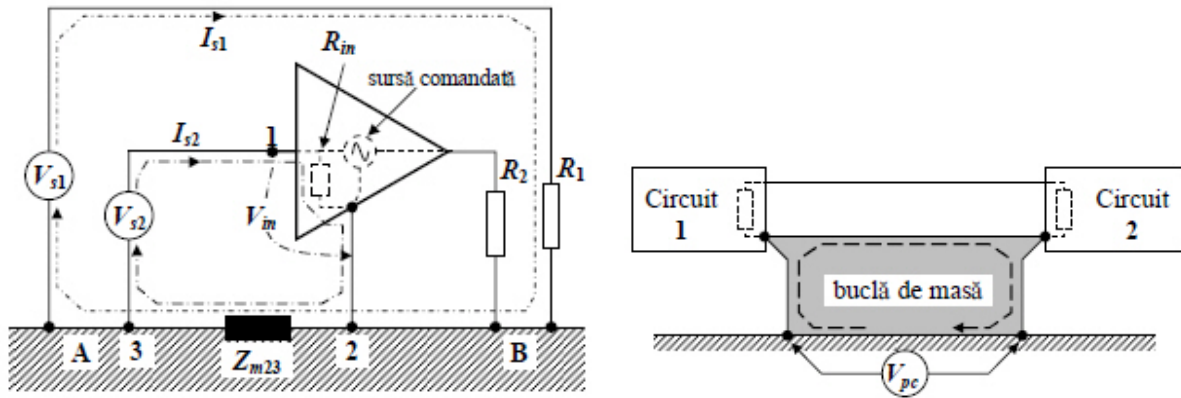


13. . Magnetic shields.

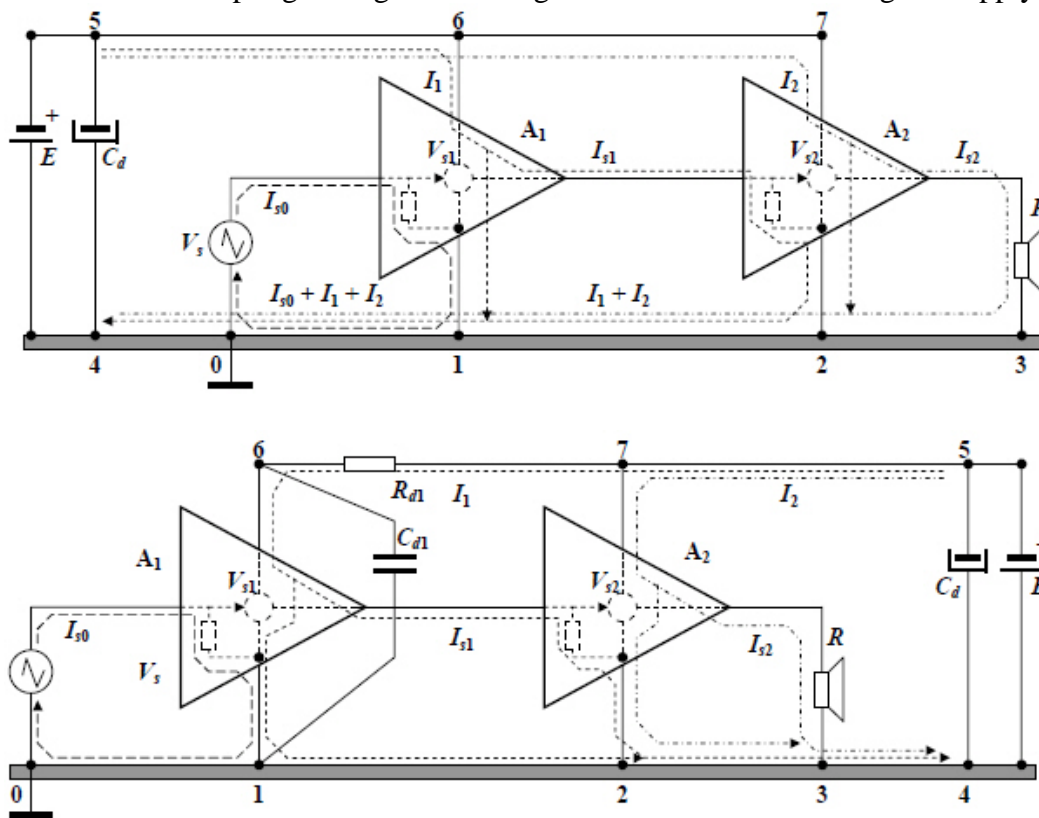




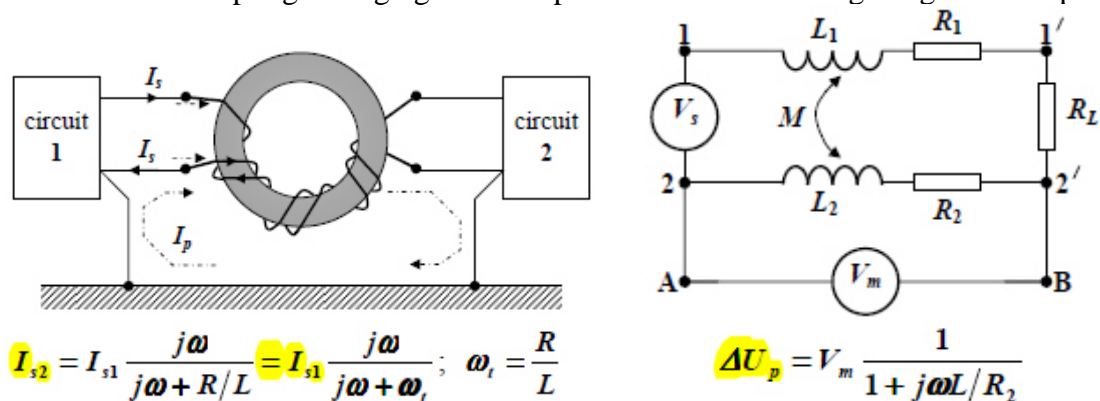
14. . The ground in electronics. Ground types. Parasitic coupling through the ground. Coupling through common ground conductor and through ground loops.



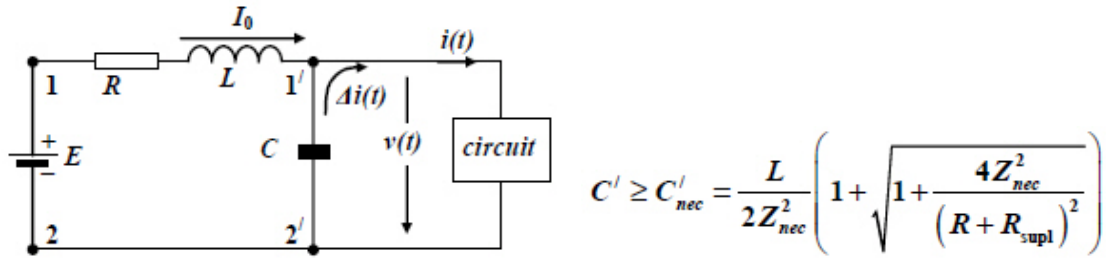
15. . Parasitic coupling through common ground conductor. Handling the supply.



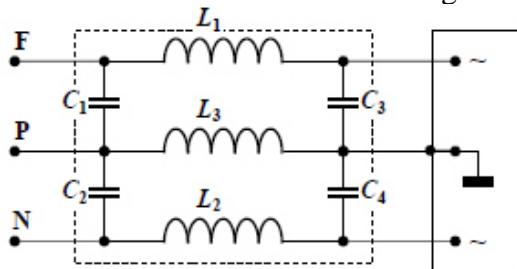
16. . Parasitic coupling through ground loops. Methods of breaking the ground loops.



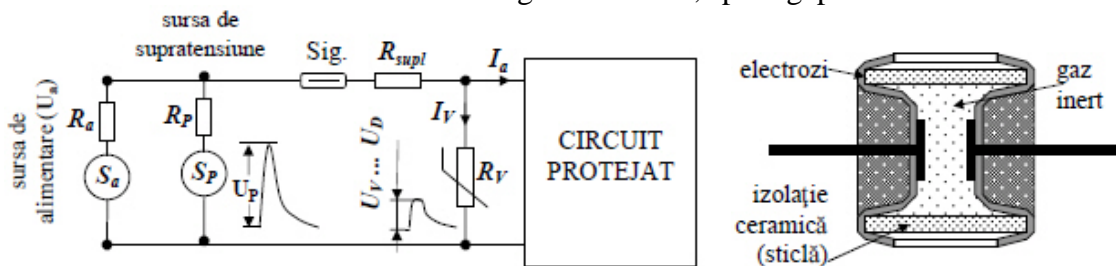
17. . Decoupling the DC power supplies. The decoupling capacitor calculation.



18. . Disturbances in the alternating current paths. Mains (or power network) filters.

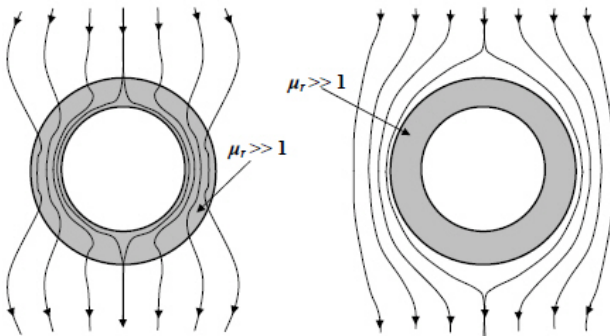
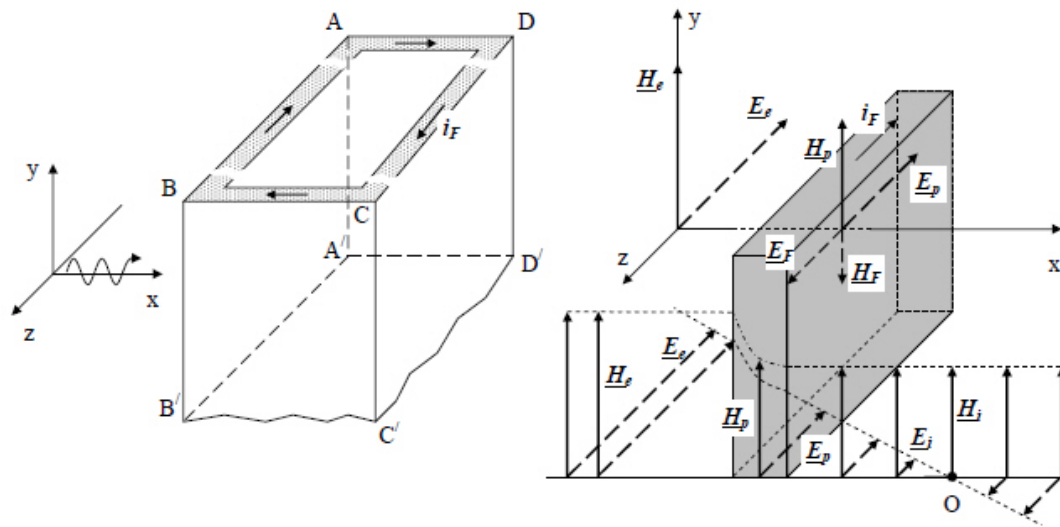


19. . Protection of AC lines to overvoltages. Varistors, spark gaps.

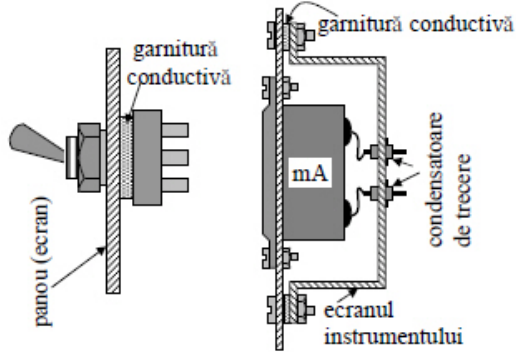




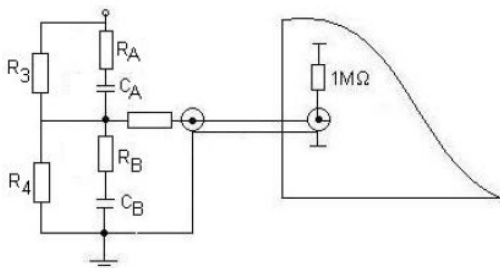
20. . Electromagnetic shields. Operation principles of electromagnetic shields, materials for shields, characteristics of materials for magnetic shields.



21. . Electromagnetic shields. The effects of joints and holes.



22. . Compatibility measurements. Voltage measuring instruments.



23. . Compatibility measurements. Current measuring instruments.

$$R \ll 2\pi f L_s$$

24. . Compatibility measurements. Electromagnetic fields measuring instruments.

