INFLUENCE OF INVERSION PROCESS
ON THE CONCEPTION OF A MICROWAVE RADIOMETER

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Microwave sensors play an increasing part in electromagnetic sensors in medical domain or in industrial control process. Our principal work domain concerns the conception and the data interpretation of near field total power [1] or correlation radiometer [2,3].

The principal advantage of this technique is a better penetration depth than infrared techniques but there is a poor spatial resolution. In microwave radiometry, the noise power measurement coming from heated materials, is directly proportional to the temperature, for an isothermal material.

But, unfortunately, the relationship describing the radiometric temperature with a non-uniform thermal gradient is a strong ill-posed problem (Fredholm equation), reinforced by a poor signal to noise ratio, due to the sensitivity of the radiometers.

We have defined a new type of microsensor of temperature where the transducer is a microelectronic transmission line. It is a coplanar waveguide, where the necessary losses for a measurement, realised by a thinning down of the central conductor, are moderates [4]. This line is connected to a correlation radiometer, which carry out the correlation function of noises waves proceeding from the dissipative line. The correlation radiometry improve the spatial resolution of this technique, but not sufficiently for a quantitative measurement of the temperature of hot spots of few hundred-micrometer. Also, after a new definition of the absolute weighting functions (AWF), corresponding to a linearisation of the direct problem, we inverse our data by a well known adaptive filter, the Kalman filter.

We show in this paper that the use of inverse technique improve the resolution (here, spatial and temperature) of the physical retrieval but also, allows to define the threshold of a new conception of the system. In other word, the necessary inverse process applied on it determines the design of the radiometer. The measurement of small bandwidth data gives the same result as a non-feasible broadband radiometer [5,6]. The development of a synthetic bandwidth radiometer is now possible and we show that it is possible to determine a quantitative value of temperature of 100 µm length hot spot. We project to use this sensor inside a three dimensional integrated circuit where the infrared techniques are not available.

REFERENCES